

1976 Cadillac SHOP MANUAL

IMPORTANT SAFETY NOTICE

Proper service and repair is important to the safe, reliable operation of all motor vehicles. The service procedures recommended by Cadillac and described in this service manual are effective methods of performing service operations. Some of these service operations require the use of tools specially designed for the purpose. The special tools should be used when and as recommended.

It is important to note that this manual contains various Warnings, Cautions and Notes which should be carefully read in order to minimize the risk of personal injury to service personnel or the possibility that improper service methods will be followed which may damage the vehicle or render it unsafe. It is also important to understand that these Warnings, Cautions and Notes are not exhaustive. Cadillac could not possibly know, evaluate and advise the service trade of all conceivable ways in which service might be done or of the possible hazardous consequences of each way. Consequently, Cadillac has not undertaken any such broad evaluation. Accordingly, anyone who uses a service procedure or tool which is not recommended by Cadillac must first satisfy himself thoroughly that neither his safety nor vehicle safety will be jeopardized by the service method he selects.

BACK TO INDEX

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1976 CADILLAC SHOP MANUAL

Service information pertaining to features exclusive to the Eldorado is provided at the back of the individual sections in this manual. All other service information for the Eldorado is the same as that described in the forward portion of the individual sections.

All information, illustrations, and specifications contained in this manual are based on the latest product information available at the time of publication approval. The right is reserved to make changes at any time without notice.

Service Department
CADILLAC MOTOR CAR DIVISION
General Motors Corporation
Detroit, Michigan 48232

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SECTION	
GENERAL INFORMATION, MAINTENANCE AND LUBRICATION	0
AIR CONDITIONING	1
FRAME AND BODY MOUNTINGS	2
FRONT SUSPENSION Front Wheel Drive	3
REAR SUSPENSION Automatic Level Control Propeller Shaft Rear Axle Differential	4
BRAKES Track Master	5
ENGINE Cooling Electrical Fuel — Carburetion — Electronic Fuel Injection Emission Control Systems Mechianical	6
TRANSMISSION	7
FUEL TANK AND EXHAUST	8
STEERING	9
WHEELS AND TIRES	10
CHASSIS SHEET METAL	11
CHASSIS ELECTRICAL Lighting System Wiring and Circuit Protection Electrical Instruments Lamp Monitor System Windshield Wiper System — Mist Radio and Antenna Instrument Panel	12
RADIATOR AND GRILLE	13
BUMPERS	14
ACCESSORIES Cruise Control Guide-Matic Twilight Sentinel Rear Window De-Fogger Windshield Wiper System — Controlled Cycle Theft Deterrent System Fuel Monitor System Sun Roof Astro Roof Automatic Door Locks	15
APPENDIX	16
INDEX OF SUBJECTS	
ELECTRICAL/VACUUM CIRCUIT DIAGRAMS	Inside Back Cover

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GENERAL INFORMATION, MAINTENANCE AND LUBRICATION

Foreword

This Shop Manual has been prepared by the Service Department of the Cadillac Motor Car Division to aid in servicing 1976 model Cadillac automobiles. It is intended primarily for servicemen who are familiar with earlier model Cadillacs. It includes complete information on service procedures and specifications specific to 1976 Cadillac cars except body and Air Cushion Restraint System (ACRS) diagnosis and service information which is covered in separate manuals. Refer to the body service manual for servicing Cadillac body items and the Air Cushion Restraint System Service Manual for diagnosis and servicing the ACRS system. Removal and installation procedures of parts which are not part of the ACRS system, but which require different procedures due to the ACRS option are included in their respective sections of this manual.

Arrangement of the Manual

The title page contains a rapid reference section index with headings corresponding to the page tabs at the beginning of each section. A Table of Contents is provided at the beginning of each section that contains more than one major subject. A complete alphabetical index is located at the back of the manual.

The individual sections include theory of operation and diagnosis at the beginning of each section followed by service adjustments and replacement procedures. An illustrated list of special tools, a torque requirement chart, and specifications are provided as required at the end of each section.

Service information pertaining only to those features that are exclusive to the Eldorado is provided at the back of the individual sections in the manual. For Eldorado service procedures and recommendations not listed, refer to the forward part of the appropriate section, as these service procedures are similar to those on other Cadillac cars.

GENERAL INFORMATION

Vehicle Identification Number

Each 1976 Cadillac automobile or commercial chassis carries a 13 digit vehicle identification number used for license and insurance identification and in general reference to the automobile. The number is located on the forward lower edge of the windshield trim molding on the driver's side of the car where it is visible through the windshield. The Cadillac identification number is decoded as follows: (Fig. 0-1)

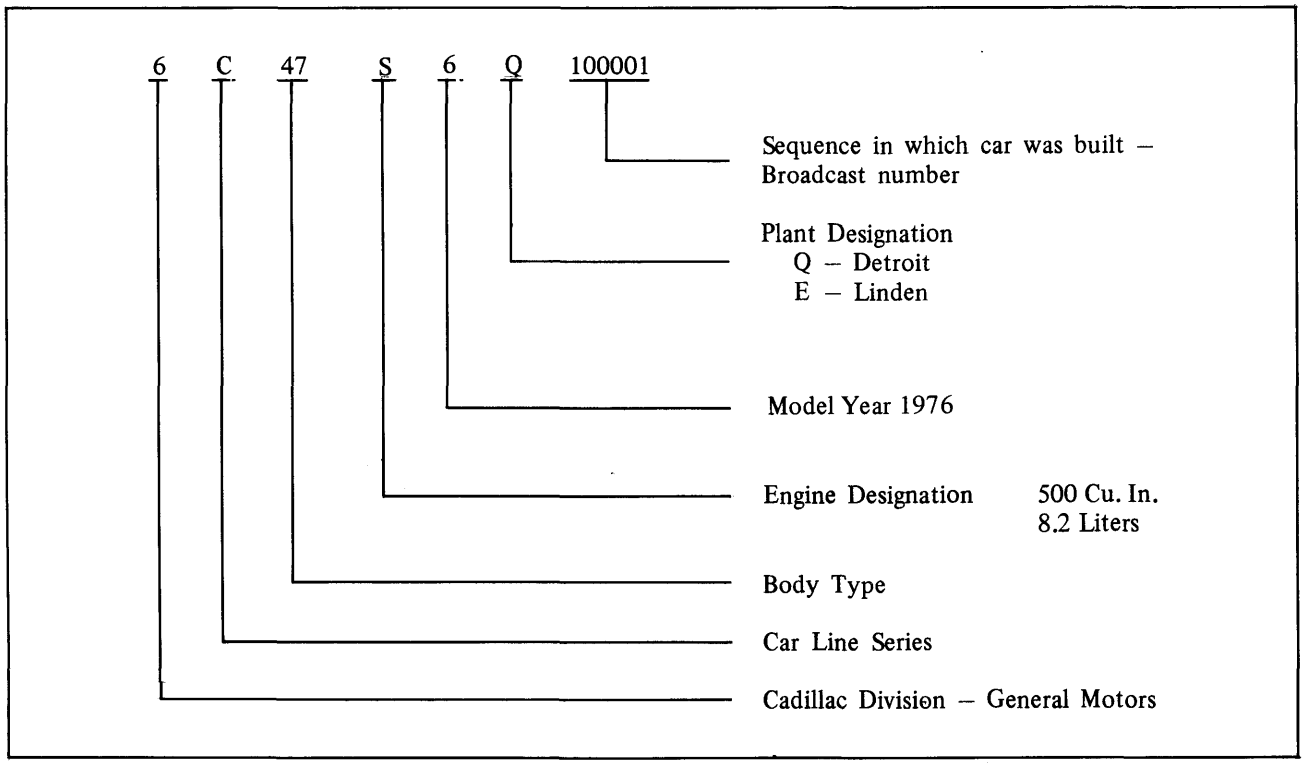


Fig. 0-1 Vehicle Identification Number

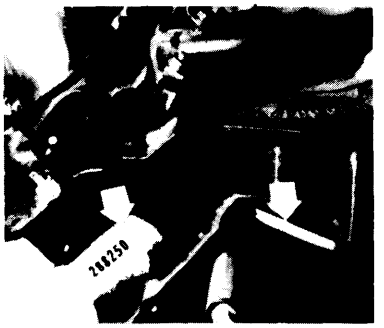
BACK TO INDEX

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The last six digits of the number determine the sequence in which the car was built. Assembly lines are assigned specific sequence numbers as follows:

100001
through
400000 Detroit built "C" series and all Eldorados.

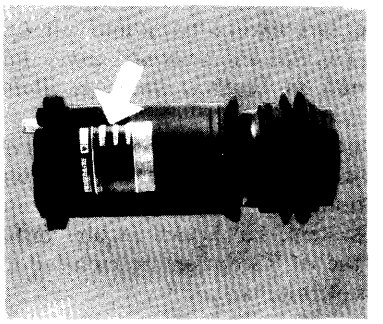
600001
through
690000 Linden built "C" series.



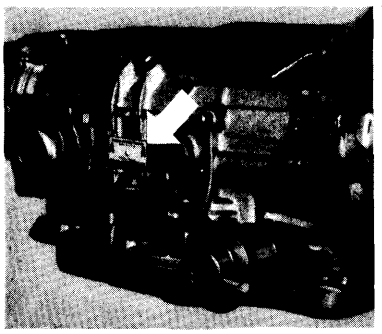
ENGINE UNIT NUMBER ON BLOCK BEHIND LEFT CYLINDER HEAD; V.I.N. DERIVATIVE ON BLOCK BEHIND INTAKE MANIFOLD



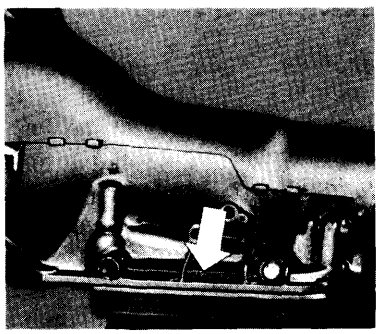
VEHICLE IDENTIFICATION NUMBER LOCATED ON PLATE RIVETED TO COWL BAR IN THE LOWER LEFT HAND CORNER OF THE WINDSHIELD.



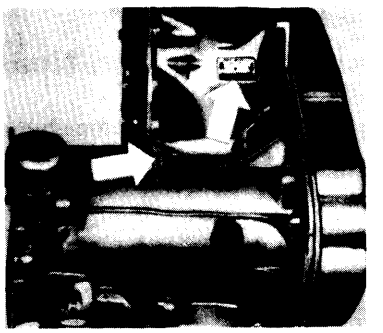
A/C COMPRESSOR SERIAL NUMBER LABEL LOCATED ON REAR PORTION OF COMPRESSOR HOUSING.



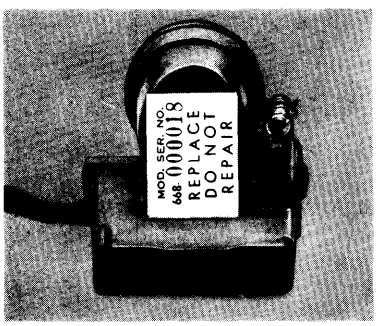
TURBO HYDRA-MATIC TRANSMISSION UNIT NUMBER PLATE LOCATED ON RIGHT SIDE OF CASE (EXCEPT 6L)



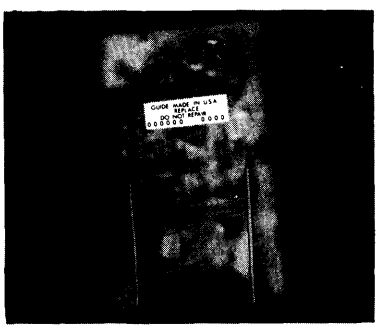
VEHICLE IDENTIFICATION NUMBER DERIVATIVE LOCATED ON LEFT SIDE OF TRANSMISSION CASE (EXCEPT 6L)



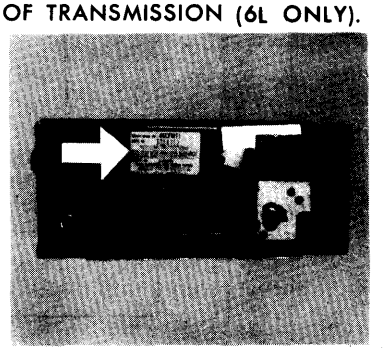
TURBO HYDRA-MATIC TRANSMISSION UNIT NUMBER PLATE LOCATED ON LEFT SIDE OF CONVERTER HOUSING. VEHICLE IDENTIFICATION NUMBER DERIVATIVE LOCATED ON VERTICAL SUPPORT PAD ON LEFT OF TRANSMISSION (6L ONLY).



GUIDE-MATIC PHOTOCELL AND AMPLIFIER SERIAL NUMBER LABEL LOCATED ON BACK OF UNIT.



TWILIGHT SENTINEL AMPLIFIER SERIAL NUMBER LABEL LOCATED ON COVER OF UNIT.



RADIO SERIAL NUMBER TAG LOCATED ON BACK SIDE OF TUNER.

Fig. 0-2 Unit Number Location

BACK TO INDEX

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CAR LINE or SERIES NAME	VIN CAR LINE/ BODY TYPE DESIGNATOR	BODY TYPE
Brougham	B69	4-Door Sedan
Calais	C49	4-Door Hardtop Sedan
Calais	C47	2-Door Coupe
DeVille	D49	4-Door Hardtop Sedan
DeVille	D47	2-Door Coupe
Fleetwood 75	F23	4-Door Sedan
Fleetwood 75	F33	4-Door Limousine
Commercial Chassis	Z90	
Eldorado	L47	2-Door Coupe
Eldorado	L67	2-Door Convertible

The series and model section (2nd, 3rd, and 4th digits) of the vehicle identification number may be further decoded using the above chart. These two numbers are interchangeable when referring to the automobile.

A nine-digit derivative of the vehicle identification number is applied to the engine and transmission at the locations shown in Fig. 0-2. This derivative is used for in-plant control of these assemblies and may be used by law enforcement or other officials to identify proper engine-chassis combinations. This number should contain the same numbers and letters as the vehicle identification number but in the condensed form shown in Fig. 0-3.

Identification Numbers

Location of identification numbers on various units are shown in Fig. 0-2. The identification number on the unit should always appear on product report forms sent to the Central Office such as PIR's, Claim Tags, Pre-Delivery Reports and, when required, on Warranty Claims. The 13 digit Vehicle Identification Number is necessary when reporting product information on any vehicle.

Body Identification Plate

A body identification plate, Fig. 0-4, is attached to the top surface of the shroud on the right side, under the hood, near the cowl. The name plate carries the style number, trim number, body number, and paint number in the areas indicated by ST, TR, BDY, and PNT.

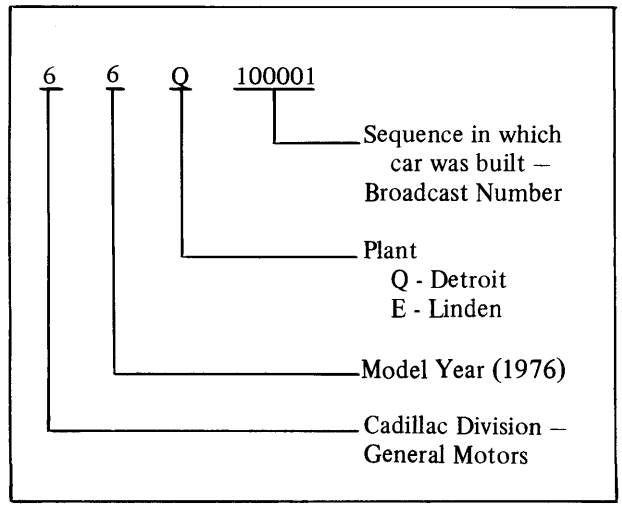


Fig. 0-3 Vehicle Identification Number Derivative

The first two digits of the style number (ST) indicate the model year while the remaining five digits indicate the model designation.

The numbers following the trim number (TR) indicate the interior trim color and seat type.

The body number (BDY) consists of three letters indicating the assembly plant and six digits indicating the sequence in which the body was built.

The first two digits of the paint number (PNT) indicate color of the body shell and chassis sheet metal; the letter indicates color of convertible and vinyl tops.

The number-letter code at the left below trim indicates date of assembly (month-01 through 12, week A through E).

Number-letter codes following the date of assembly indicate Fisher Body options and accessories installed at the factory.

Keys

All 1976 Cadillacs use TWO specific keys.

1. Square head – used for ignition switch ONLY.
2. Oval head – used for doors, glove box and trunk.

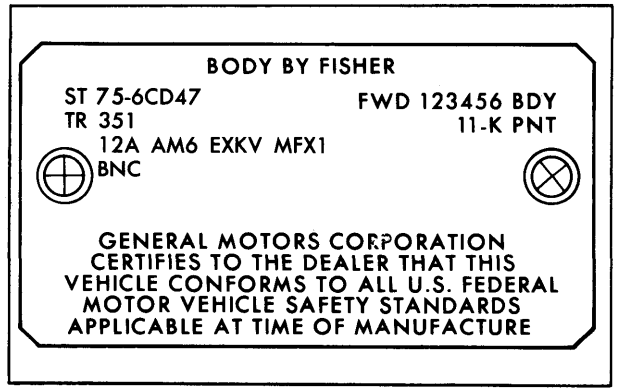


Fig. 0-4 Body Identification Plate

BACK TO INDEX

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In addition, a third specific notched oval head key is used for the following applications.

1. Console lock on Brougham Talisman.
2. Right rear door on the Fleetwood "75" Limousine.

Towing Instructions

Refer to the General Motors 1976 Passenger Car and Light Truck Towing Instructions Manual.

Pushing or Pulling Car to Start Engine

CAUTION: Vehicle must not be pushed or towed to start.

Since there is no direct mechanical link from the engine to the drive wheels, any attempt to start the engine by pushing the car will be unsuccessful. Should the battery become discharged, it will be necessary to use an auxiliary battery with jumper cables to start the engine.

Jump Starting with Auxiliary (Booster) Battery

CAUTION: The following jump start procedure is for use only under the following conditions. Departures from these conditions and procedures, could result in: (1) serious personal injury (particularly to eyes) or property damage from such things as battery acid or electrical burns, or (2) damage to electronic components in either vehicle. If all the conditions cannot be met, or if you are uncertain about them, we strongly recommend for your safety and that of the car that jump starting be done only by a competent mechanic.

The battery in the other vehicle must be 12 volts and negatively grounded. The nominal voltage and grounding of the vehicle's battery may be determined by checking the specifications in its owner's manual. Use of a booster battery of a higher nominal voltage, or which is positively grounded may result in serious personal injury or property damage.

CAUTION: Never expose battery to open flame or electric spark—battery action generates hydrogen gas which is flammable and explosive. Don't allow battery fluid to contact eyes, skin, fabrics, or painted surfaces—fluid is a corrosive sulfuric acid solution which could cause serious personal injury or property damage. Flush any contacted area immediately with water. Wear eye protection such as industrial safety spectacles or goggles when working on or near battery. Remove rings, metal watch bands and other metal jewelry before jump starting or working around a battery. Be careful in using metal tools and equipment. If such metal should contact the positive battery terminal (or metal in contact with it) and any other metal on the car, a short circuit may occur which could cause personal injury. Batteries and acid should always be kept out of reach of children.

The battery, called a freedom battery, is a sealed-type battery that does not have filler openings or caps. If the car contains a replacement battery other than a sealed type, refer to jump starting instructions provided by the manufacturer of the battery.

Jump Start Procedure:

1. Position the two vehicles so they are NOT touching. Set parking brake and place automatic transmission in "PARK" in each vehicle. Also turn off lights,

GENERAL DESCRIPTION AND SPECIFICATIONS

Description	Model Designation Number	Shipping Weight (Less Options)	Wheelbase (Inches)	Overall Length (Inches)	Overall Height (Inches)	Maximum Width (Inches)	Tread Width	
							Front	Rear
Fleetwood Sixty Special Brougham	6B69	5242	133.0	233.7	55.3	79.8	63.3	63.3
Calais Sedan	6C49	5087	130.0	230.7	54.3	79.8	63.3	63.3
Calais Coupe	6C47	5003	130.0	230.7	53.8	79.8	63.3	63.3
Sedan de Ville	6D49	5146	130.0	230.7	54.3	79.8	63.3	63.3
Coupe de Ville	6D47	5049	130.0	230.7	53.8	79.8	63.3	63.3
Eldorado Coupe	6L47	5108	126.3	224.1	54.1	79.8	63.7	63.6
Eldorado Convertible	6L67	5167	126.3	224.1	54.5	79.8	63.7	63.6
Fleetwood Seventy-Five Sedan	6F23	5720	151.5	252.2	56.8	79.8	63.3	63.3
Fleetwood Seventy-Five Limousine	6F33	5862	151.5	252.2	56.6	79.8	63.3	63.3
Commercial Chassis	6Z90	–	157.5	–	–	–	63.3	65.0

BACK TO INDEX

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heater and all other unnecessary electrical loads.

2. Remove the vent caps, if so equipped, from the battery in the other car (unless it also is equipped with Delco flame arrestor caps). Lay a cloth over the open vent wells. These two actions help reduce the explosion hazard always present in a battery when connecting "live" booster batteries to "dead" batteries. For safety's sake, do not remove any of the flame arrestor vent caps from a battery so equipped.

3. Attach one end of one jumper cable to the positive terminal (identified by a red color, "+" or "P" on the battery case, post or clamp) of the battery in the booster battery, and the other end of the same cable to the positive terminal of the discharged battery.

4. Attach one end of the remaining jumper cable FIRST to the negative terminal (black color, "–" or "N") of the battery in the booster battery, and THEN the other end of the same cable to the negative terminal of the discharged battery. Take care that clamps from one cable do not inadvertently touch the clamps on the other cable. Do not lean over the battery when making this connection.

5. Start the engine in the vehicle that is providing the jump start. Let it run a few minutes, then start the engine in the car with the discharged battery.

6. Reverse the above sequence exactly when removing the jumper cables. Reinstall vent caps and dispose in a safe manner of any cloths used to cover vent wells, as the cloths may have corrosive acid on them.

Hoist Recommendations (Except Eldorado)

CAUTION: Failure to follow the recommendations outlined below may result in unsatisfactory vehicle performance, or a decreased durability which may result in loss of control of the vehicle.

The preferred type of hoist for lifting Cadillacs is one that engages the front suspension and rear axle, or all four wheels.

The front lower suspension arm is designed with a flattened portion on the flange of the arm for use with lifting equipment that engages the suspension system. When using lifting equipment of this type, make certain that the car is properly centered over the hoist and that the hoist arms are positioned under the flattened portion of the flange, Fig. 0-5., outboard of the safety locaters. If the hoist arms are not properly positioned in relation to the lower support arms, damage to the steering linkage or brake lines could result, or the car may shift on the hoist.

CAUTION: The rear lower control arms should never be used as a lift point.

If a frame-engaging hoist is used, certain precautions must be observed. The shaded areas of the frame, Fig. 0-6, indicate the only acceptable positions for lift pads. Pads must be used in these areas with maximum surface contact and must contact only those parts of the frame indicated.

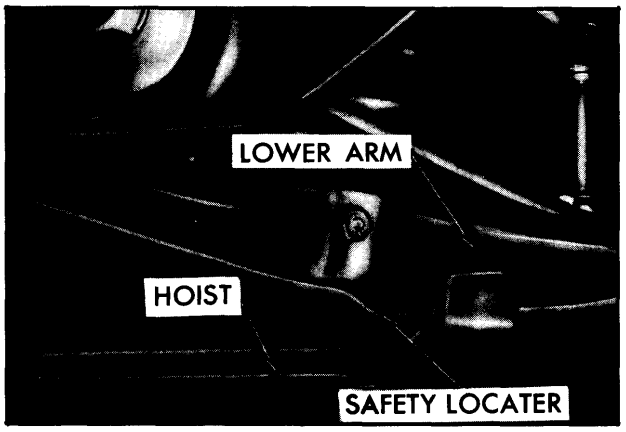


Fig. 0-5 Front Hoist Saddle Position—Exc. Eldorado

(NOTE: Certain cars are equipped at these locations with special brackets used for rail shipment. If such a situation is encountered, be sure to engage bracket fully rather than at the edges.)

Do not use a frame-engaging hoist to raise the Fleetwood Seventy-Five Sedan and Limousine or the Commercial Chassis.

CAUTION: The shock absorbers act as rebound stops for the rear suspension. Under no circumstances should the rear end of car be raised so that rear suspension is in rebound position while disconnecting shock absorbers.

Hoist Recommendations (Eldorado Only)

CAUTION: Failure to follow the recommendations outlined below may result in unsatisfactory vehicle performance, or decreased durability which may result in loss of control of the vehicle.

The preferred type of hoist for lifting the Eldorado is one that engages the front suspension and rear axle or all four wheels.

Use of a suspension-engaging hoist requires that certain procedures be observed.

Be sure front hoist saddle adapters engage lower suspension arm just inboard of stabilizer linkage (both sides), Fig. 0-7, to prevent damage to steering linkage.

When using a suspension engaging hoist place "saddles" of hoist in the maximum "inward" position and under the rear axle to prevent damage to Automatic Level Control overtravel lever bracket, fuel lines, and brake lines. Continue to raise the hoist slowly until contact with the rear axle. Complete lifting operations.

CAUTION: The rear lower control arm should never be used as a lift point. Doing so could result in damage to the rear suspension and non standard vehicle performance.

BACK TO INDEX

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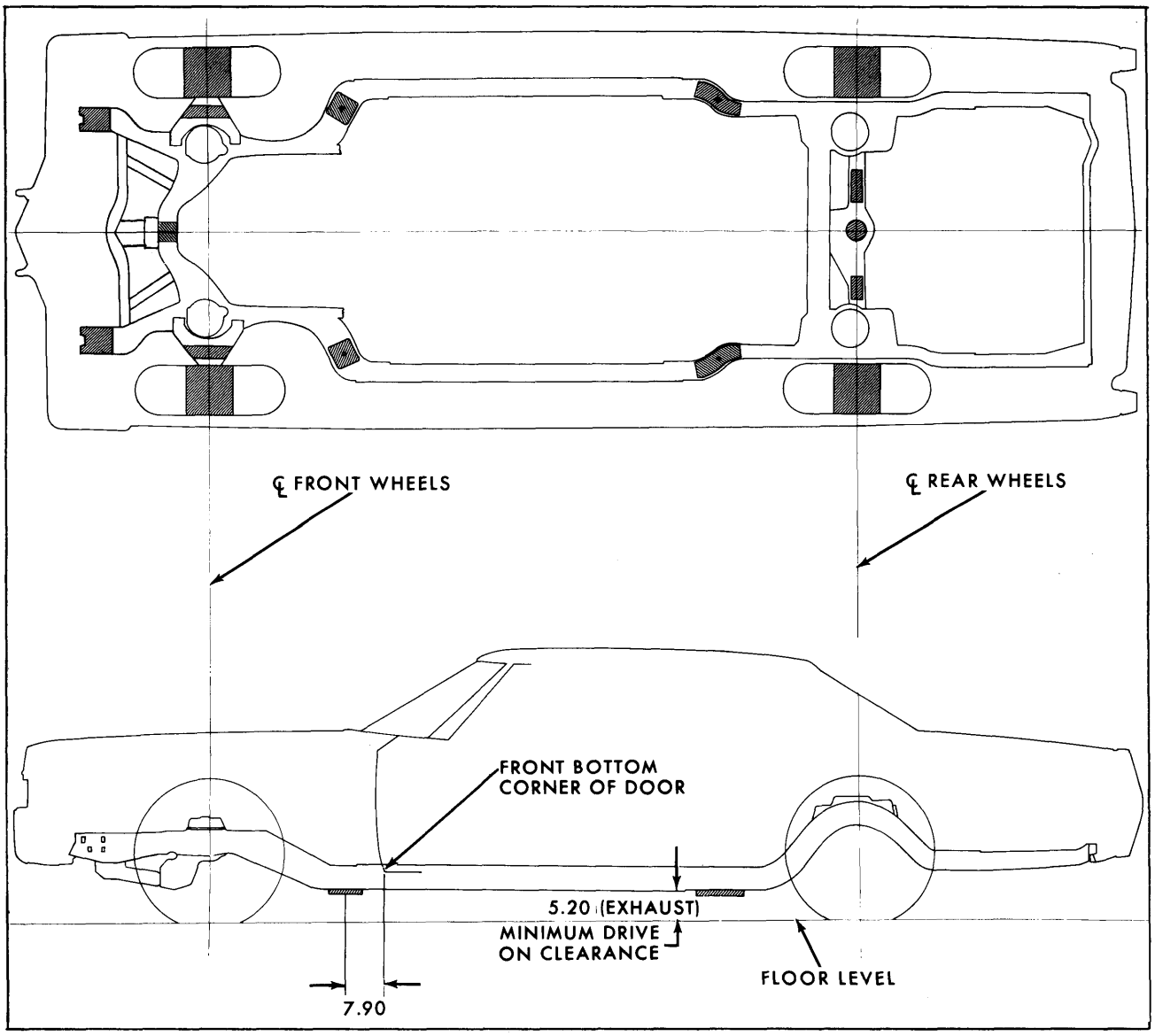


Fig. 0-6 Lifting Locations—Esc. Eldorado & Commercial

If a frame engaging hoist is used, certain precautions must also be observed.

Make sure that hoist adapters and "tabs" are in lowered position before driving on or off the lift.

Position hoist adapter "tabs" in raised position to obtain maximum possible height between frame and hoist.

Be sure to position adapter tabs in exact locations shown in the shaded areas of Fig. 0-9 and make sure the centerline of the door is behind the centerline of the lift post for proper weight distribution.

(NOTE: Certain cars are equipped at these locations with special brackets used for rail shipment. If such a situation is encountered, be sure to engage bracket fully rather than at the edges.)

An additional precaution of using two floor stands under the front frame cross member of the Eldorado is recommended when heavy mechanical operations are to be performed. Be sure to remove these stands before attempting to lower the vehicle.

If a drive-on hoist is used, be sure the center line relationship as stated above is also applied, Fig. 0-9.

When supporting the Eldorado with a floor jack or jack stands, the supports should be placed at the suspension lift points or the frame contact lift points. The Eldorado should never be supported at the extreme ends of the frame or at the center of the frame side rail or lifted at the front or rear bumper with anything other than the bumper jack provided with the car.

BACK TO INDEX

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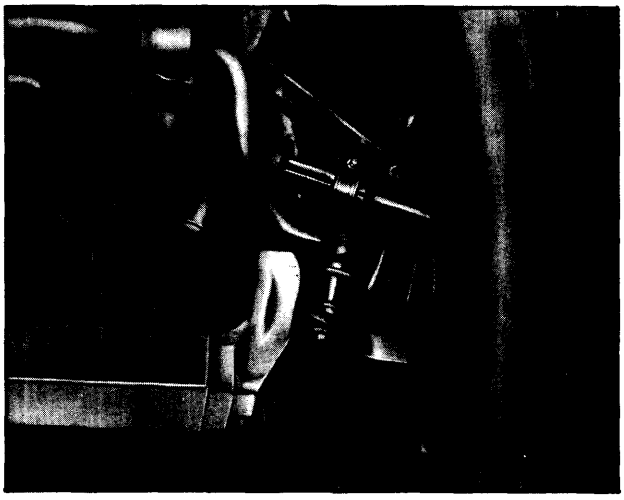


Fig. 0-7 Front Hoist Saddle Position—Eldorado

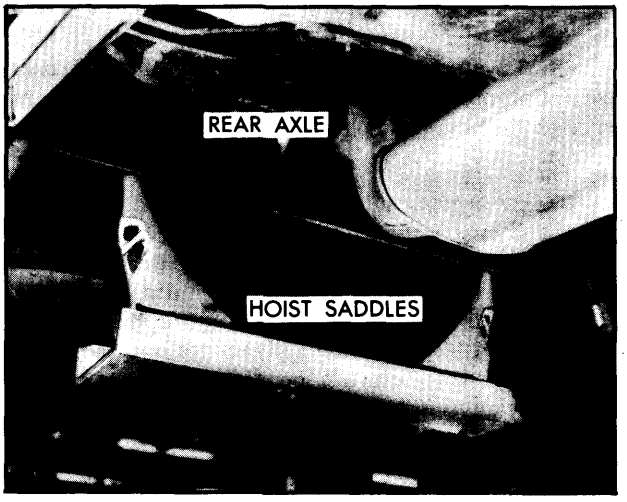


Fig. 0-8 Rear Hoist Saddle Position—Eldorado

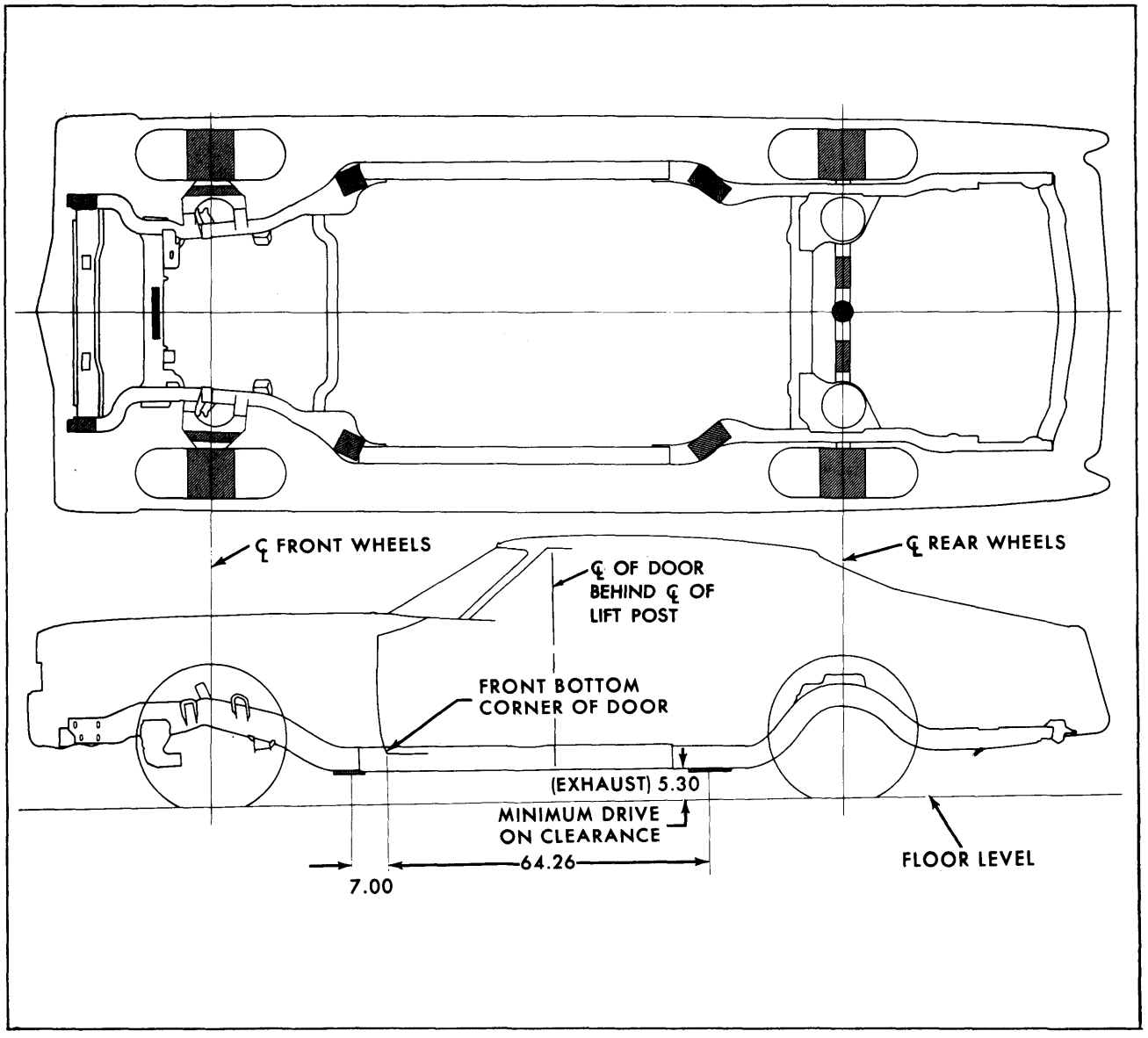


Fig. 0-9 Lifting Locations—Eldorado

BACK TO INDEX

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VIBRATION COMPLAINTS AND CORRECTION

(NOTE: Before proceeding with the vibration correction procedure make certain any and all performance problems are completely resolved.)

There are several excitation sources and many responding systems which may cause an annoying vibration. The first step is to identify individual vibration complaints by systematically classifying them, during a road test, into one or more of the following categories: (1) car speed sensitive, (2) engine speed sensitive, (3) torque (throttle) sensitive, or (4) jounce sensitive. Since each of these categories has specific vibrations associated with it, this classification will give direction to the proper area for analysis of the problem. This will eliminate many components that cannot be the cause, and will focus attention on only those items that can contribute to the specific condition encountered.

1. Road Test

Prior to the initial road test, check and adjust the tire pressures and install an engine tachometer. Next, ride the car with the owner driving and have him point out the disturbance with which he is concerned.

(NOTE: The importance of riding in the car with the owner cannot be over-emphasized.)

If the condition is normal, and no corrective work is needed, the owner should be told immediately. This normalcy can be demonstrated with other vehicles, pointing out that similar vehicles have the same condition.

2. Sensitivity Classification

Having verified that a vibration problem does exist, the first step in correcting the problem is to classify it in terms of one or more of the following sensitivity categories.

a. Car Speed Sensitive

Most vibration complaints will be found to be car speed sensitive, i.e., the frequency of the excitation depends only on the speed of the vehicle. To determine if a given problem is car speed sensitive:

(1) Drive the car in "Drive Left" and record the car speed and the engine RPM at which the problem occurs.

(2) Shift the car into "Drive Right" and again record the car speed and the engine RPM at which the problem occurs.

(3) If the problem occurs at the same car speed as when the car was in "Drive Left", the vibration is car speed sensitive.

(NOTE: It is possible that two problems could occur at the same car speed. Decelerate the engine to the RPM obtained in Step 1 and check to see that problem has disappeared. If it has not, there are two problems: one of which occurs at the car speed determined in Step 1, while the second occurs at the engine speed determined in Step 1.)

b. Engine Speed Sensitive

Another group of vibration complaints will be found to be engine speed sensitive, i.e., the frequency of the excitation depends only on the speed of the engine, independent of the speed of the vehicle. To determine if a given problem is engine speed sensitive.

(1) Drive the car in "Drive Left" and locate the vibration problem. Record the car speed and the engine RPM at which the problem occurs.

(2) Shift the car into "Drive Right" and again locate the vibration problem. Record the car speed and the engine RPM at which the problem occurs.

(3) If the problem occurs at the same engine speed as when the car was in "Drive Left", the vibration is engine speed sensitive.

c. Torque Sensitive

A torque sensitive problem is one which increases in intensity as the torque (power) output of the engine increases, i.e., the intensity of the vibration increases as the throttle opening is increased. To determine if a given problem is torque sensitive:

(1) Drive the car in "Drive Left" and record the car speed and engine RPM at which the problem occurs.

(2) Observe the condition while varying the throttle position. Drive the car with steady throttle, slowly increasing to heavy throttle by going up hill or applying the brakes while increasing the throttle opening, and slowly decreasing to minimum throttle by coasting through the vibration speed.

(3) If the condition becomes more severe as the throttle opening is increased, the vibration is torque sensitive.

d. Jounce (or Load) Sensitive

A jounce (or load) sensitive problem is one which varies in intensity as the height of the car changes with respect to the surface of the road, i.e., the intensity varies as the rear springs are extended or compressed. To determine if a given problem is jounce (or load) sensitive:

(1) Drive the car and observe the condition with varying passenger load.

(2) Alternately, drive the car over a road that dips in such a way that is causes the rear of the car to move up and down relative to the surface of the road. Keeping a constant throttle, observe the condition.

(3) If the condition varies depending on the passenger load (or varies as the rear of the car moves up and down), the problem is jounce (or load) sensitive.

e. Multiple Classification

In the process of classifying vibration problems in terms of these four sensitivity categories, you will find that many problems fit more than one of the categories. Combining these categories into their possible combinations, the majority of all vibration problems will fall into one of the following "cases" of categories:

(1) Engine speed sensitive only
(2) Car speed sensitive only
(3) Torque sensitive and car speed sensitive
(4) Torque sensitive and engine speed sensitive

3. Engine Speed Sensitive Only

Problems in this class may be duplicated with the car stopped and the transmission in neutral by running the engine at the RPM at which the disturbance was felt

BACK TO INDEX

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during the road test. All additional appraisals can thus be made under this "free engine" condition.

"Free engine" problems can be due to belts or engine driven accessories (power steering pump, generator, air conditioning compressor, fan, etc.). To isolate the offending component, first check the torque on all accessory mounting bracket bolts. Also, check the condition and tension of all accessory drive belts. If any abnormal conditions are found, correct and retest for the vibration problem.

Air conditioning compressor problems can be diagnosed by turning compressor off and on while the vibration problem is being experienced.

If tightening the accessory mounting bolts and adjusting the drive belt tensions fails to correct the disturbance, remove accessory drive belts, one at a time, tighten the accessory mounting bolts, and retest for the problem. Continue to remove the belts one at a time until the offending component is located.

CAUTION: With the water pump drive belt removed, the engine may overheat rapidly resulting in possible engine damage; hence, this appraisal must be made very quickly.

4. Car Speed Sensitive Only

All tire problems are sensitive to car speed only. Driveline unbalance or runout is sensitive to car speed at the rate of one vibration per revolution (First Order). Driveline vibrations at the rate of two or more vibrations per revolution, on either "C" cars or Eldorado, are sensitive to both car speed and torque, and should not be considered as "car speed sensitive only".

a. Suspension Hop and Tramp (Tire Balance)

In order to verify suspension hop & tramp as excited by tire balance and/or runout, proceed as described in Section 10.

b. Balancing Wheels, Tires, and Brake Drums

Many wheel balancers will adequately balance the wheel-tire-brake drum assembly; however, it is the skill of the operator that really is important. The operator must be well trained on the equipment used.

c. Checking Tire, Wheel Brake Rotor and Rear Axle Runout

Excessive runout will cause a vibration which is exactly like unbalanced wheels and tires. After balancing tires, if a 1st order tire disturbance still exists, check runout as follows:

1. Wheel and Tire Runout

Follow procedure described in Section 10. If the runout cannot be reduced to acceptable values by repositioning the tire and wheel, replace the parts at fault. Retest on the road.

2. Brake Rotor and Axle Shaft Runout

a. If after checking wheel runout (radial and lateral), it is determined that excessive runout is present, check brake rotor or axle shaft for runout with a dial indicator before replacing wheel. Refer to Section 5 for specifications on rotor runout.

b. If lateral (in-out) wheel runout (wobble) is beyond specifications, check hub and rotor to wheel pads (front end) or axle flange (rear end) for lateral runout. The dial indicator stem should contact the axle flange or hub and rotor pads as close as possible to the outboard side of the studs.

d. Tire Radial Force Variation

If the disturbance is still present, the problem is due to a non-uniformity in one or more of the tires. This fault is inherent in the tire and often cannot be corrected by any means other than replacement. The problem which remains at this point, however, is to isolate the offending tire(s). This may be accomplished by using a machine capable of measuring loaded radial runout. See Section 10.

5. Torque Sensitive and Car Speed Sensitive

The only excitation which is both car speed sensitive and torque sensitive is 2nd Order driveline (two vibrations per revolution) on the "C" car or 3rd Order Driveline (three vibrations per revolution) on the Eldorado. These problems are caused by improper drive shaft angles which are a result of wrong standing height or faulty joints. Refer to Section 3, to check standing height. Drive axle joint replacement is described in Section 3. Constant velocity universal joint repair is described in Section 4.

6. Torque Sensitive and Engine Speed Sensitive

The only excitation which is both engine speed sensitive and torque sensitive is the "firing order" excitation (that is, 4th Order for an eight cylinder engine). The problems likely to be encountered in this class are as follows:

a. An engine-driven accessory (power steering pump, generator, air conditioning compressor, etc.) excited by 4th Order Engine.

Engine driven accessories generally do not present a problem if all attachment bolts are torqued to specifications and all drive belts are adjusted to the proper tension. In order to verify that an engine-driven accessory is not the cause of a vibration complaint:

(1) Check installation torques on all attachment bolts securing either an accessory to its mounting or the mounting to the engine.

(2) Check all drive belts for correct tension. Also check the physical condition of the belts.

(3) Visually inspect each accessory to ensure that the brackets installed are complete and properly assembled.

The checks outlined above should be performed and any irregularities corrected before proceeding.

b. Power plant "bending" as excited by 4th Order Engine.

Loosen the top four bolts which attach the transmission to the engine, and reappraise the problem. If this is the actual cause of the complaint, the problem should now occur at a much lower engine speed than it did originally, or be completely eliminated. Retorque bolts before proceeding.

Having thus verified that this is the actual cause of the complaint, the following procedures are suggested as a means of correction:

(1) Inspect the vehicle to be sure the entire engine-transmission assembly and the exhaust system are not in contact with the frame or body.

BACK TO INDEX

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(2) Inspect the engine and transmission mounts to be sure they have not sagged, or deteriorated.

(3) Check the initial spark advance setting.

(4) If these inspection procedures reveal any irregularities, correct and retest on the road.

c. Exhaust system "bending" as excited by 4th Order Engine. (This may include either the crossover pipe, exhaust pipe, or tailpipe.)

CAUTION: It is often convenient to test for exhaust system vibrations by stalling the engine in Drive with the brakes applied. However, a car should never be stalled at engine speeds greater than 1200-1300 RPM and never for extended periods of time, since the transmission may overheat. When this method of testing is used, it is best done on a hoist, permitting the driveline and rear axle to rotate after each appraisal to circulate transmission oil. Do not use this test method for any problem occuring above 1300 RPM.

When a particular component of the exhaust system, such as the exhaust pipe or tailpipe, is suspected of causing a vibration problem, it may be verified by the following procedure:

(1) Put the car on a hoist with a helper behind the wheel and all doors and windows closed. Next, stall the vehicle in "Drive" as described above in the problem RPM range, while pressing a metal object (such as a wrench or screwdriver) lightly against the suspected component. If this component is the cause, it will "buzz" or "rattle" against the wrench or screwdriver due to its vibratory motion.

(2) To further verify that the suspected component is the cause, pull down rather heavily on that component while the driver evaluates the problem RPM range for any reduction in the level of the disturbance. This method of verification may also be applied on a road test by clamping a 5-10 lb. metal weight securely to the suspected component. Such a weight will change the resonant frequency of the component in question, and will change the problem speed if it is actually the cause.

(3) To verify disturbances produced by exhaust system components which resonate beyond 1300 RPM (such as the exhaust crossover), the stall technique cannot be used. In these cases, it is best to use the weight-and-clamp method together with a road test.

Having verified that some component of the exhaust system is the cause of the problem, the following procedures should be used to correct the disturbance.

(a) Since the majority of exhaust system problems are due to "bound up" conditions, loosen all joints in the entire system, and let the pipes rest on floor stands while each clamp and bolt is torqued to specification. Refer to Section 8.

(b) Visually inspect the entire system for sufficient clearance of all points, (at least 1/2" in all directions) especially those in the direction of engine roll under acceleration.

c. Visually inspect all exhaust system hangers to ensure that there is no metal-to-metal contact.

d. Ensure that the end of the tailpipe is not directed at the inside surface of the rear bumper, but below it.

e. After these procedures have been performed and any irregularities corrected, retest on the road.

CAR STORAGE PREPARATION

Certain precautions must be taken when placing a car in storage for extended extended periods of time. Listed below are the recommendations to be followed when storing a car for 30 days or less, and for a period of 30 days to 12 months.

a. Car Storage Preparation—30 Days or Less

1. Wash car and inflate tires to 40 pounds pressure.
2. Provide proper cooling system protection. (At least -40°F -40° C).
3. Run engine until completely warmed up; then drain and refill with fresh oil which, according to the label on the can is intended for service "SE".
4. Run engine again with fresh oil until completely warmed up; drive car to place of storage and park. Do not restart again until end of storage period.
5. Be sure parking brake is in released position and car is on level surface.
6. If car is to be stored in a hot area, the fuel tank, lines, pump, filter, and carburetor or intectors if so equipped should be drained.
7. Disconnect battery and prevent battery from discharging or freezing by keeping it fully charged.

b. Car Storage Preparation—30 Days to 12 Months

1. Wash car.
2. Run engine until completely warmed up; then drain and refill with fresh oil which according to the label on the can is intended for service "SE".
3. Run engine again with fresh oil until completely warmed up; drive car to storage area. Run engine at 2,000 rpm in neutral and slowly pour engine oil into carburetor or both throttle body bores in the case of electronic fuel injection. After about a pint has been added, pour oil fast enough to stall engine.
4. Be sure parking brake is in released position and car is on level surface.
5. Siphon gasoline from fuel tank.
6. Disconnect all fuel lines, blow out, and reconnect.
7. Remove carburetor, clean thoroughly, and store in plastic bag.
8. Remove fuel pump, clean, and store with carburetor.

(NOTE: Tape fuel pump, carburetor, and gas line openings closed with masking tape.)

9. On Electronic fuel injection use following procedure.

a. Disconnect fuel lines from EFI fuel rail fitting rearward including in-line pump and filter.

b. Remove filter assembly and discard. Blow fuel from fuel lines and filter.

BACK TO INDEX

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c. Reconnect fuel lines, fuel pump and filter housing.

d. Remove 10 amp in-line fuel pump fuse located near ECU connectors.

e. Crank engine approximately 20 seconds to remove fuel from injectors.

Install 10 amp fuel pump fuse.

10. Drain coolant from radiator, cylinder block, and heater cores.

11. Lower windows 1/2 inch to stop humidity "sweat" and mold.

12. Remove battery from car, and have charge maintained during period car is stored.

13. Put car on chassis stands so that tires are off the floor. Position stands under front lower control arms and rear axle as shown in Figures 0-4 through 0-8.

14. Apply 10W engine oil to exterior bright surfaces.

15. When car is taken out of storage, install a new fuel filter element, check brake system for leaks, and bleed brakes. Clean sprak plugs and regap. Install carburetor, fuel pump, and battery, and refill cooling system.

Special consideration should be given when conditions of high humidity, high temperature, or outdoor storage are encountered. Local experience will dictate the additional protection measures in each particular case.

1976 CADILLAC MAINTENANCE SCHEDULE

To retain the safety, dependability and emission control performance originally built into Cadillacs, it is essential that they receive periodic inspections, maintenance and service parts replacements.

This section contains a complete schedule of the maintenance required by the vehicles, except that additional maintenance requirements for optional Air Cushion Restraint Systems are listed in the ACRS manual.

These inspection and maintenance services are those which experience and testing have shown to be the most likely needed services at that particular mileage or time interval for an average owner. However, the Cadillac serviceman should also recommend additional items of maintenance based on driving habits, driving conditions, geographical locations, climatic conditions, and factory service bulletins.

Explanation of Complete 1976 Vehicle Maintenance Schedule

Presented below is a brief explanation of each of the services listed in the following Complete Vehicle Maintenance Schedule.

Normal Vehicle Use

The owner's maintenance instructions contained in this maintenance schedule are based on the assumption that your car will be used as designed:

- To carry passengers and cargo within the limitations indicated on the vehicle tire placard affixed to the inside surface of the glove box door.
- On reasonable road surfaces within legal operating limits.
- On a daily basis, as a general rule, for at least several miles, and
- On unleaded fuel.

Unusual operating conditions will require more frequent vehicle maintenance as specified in the respective sections included below.

After each of the following maintenance services is performed, it is recommended that you insert the date in the maintenance schedule under the appropriate "Owner Service Log" column.

(NOTE: The shaded blocks indicate when services should be performed based on mileage intervals as shown in the "When To Perform Services" column.

Section A
Lube & General Maintenance

ITEM NO. **SERVICES**

A-1 CHASSIS* – Lubricate all grease fittings in front suspension, and steering linkage. Also lubricate transmission shift linkage, primary and secondary hood latch, hood hinges, and parking brake cable guides and linkage.

A-2 FLUID LEVELS●* – Check level of fluid in brake master cylinder●, power steering pump●, engine*, axle, transmission* and windshield washer●. Engine coolant should be checked for proper level and freeze protection to at least -40°F. (-40°C.) or to the lowest temperature expected during the period of vehicle operation.* Proper engine coolant also provides corrosion protection.

Any significant fluid loss in any of these systems or units could mean that a malfunction is developing and corrective action should be taken immediately. A low fluid level in the brake master cylinder front reservoir could also be an indicator that the disc brake pads need to be replaced.

A-3 ENGINE OIL* – Change each 6 months or 7,500 miles, whichever occurs first under normal driving conditions, or each 3 months or 3,000 miles when the vehicle is operated under the following conditions: (a) driving in dusty conditions, (b) trailer towing, (c) extensive idling or (d) short-trip operation at freezing temperatures (with engine not thoroughly warmed-up). See your Owner's Manual for additional details on engine oil.

A-4 ENGINE OIL FILTER* – Replace at the first oil change and every other oil change thereafter.

A-5 TIRES – Steel belted radial tires should be

●Also a Safety Service *Also an Emission Control Service

BACK TO INDEX

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1976 CADILLAC — COMPLETE VEHICLE MAINTENANCE SCHEDULE

When To Perform Services (Months or Miles whichever occurs first)	Item No.	Services (For Details, See Numbered Paragraphs)	Mileage When Service Is To Be Performed					
			7.5	15.0	22.5	30.0	37.5	45.0
Section A – Lubrication and General Maintenance								
Every 6 Months or 7,500 Miles	A-1	*Chassis Lubrication	X	X	X	X	X	X
	A-2	•*Fluid Levels Check	X	X	X	X	X	X
	A-3	*Engine Oil Change	X	X	X	X	X	X
At 1st Oil Chg. – Then Every 2nd	A-4	*Oil Filter Change	X		X		X	
See Explanation	A-5	Tire Rotation (Steel Belted Radial)	X		X		X	
	A-6	Rear Axle Lube Change						
Every 12 Months	A-7	Air Conditioning Check		yrly.		yrly.		yrly.
Every 12 Months or 15,000 Miles	A-8	*Cooling System Check		X		X		X
		*–Coolant Change				X		
See Explanation	A-9	Wheel Bearing Repack				X		
Every 30,000 Miles	A-10	Final Drive Boots & Seals Check (Eldorado)				X		
Every 100,000 Miles	A-11	*Auto. Trans. Fluid & Filter Change						
Section B – Safety Maintenance								
Every 6 Months or 7,500 Miles	B-1	Owner Safety Checks	X	X	X	X	X	X
	B-2	Tire, Wheel and Disc Brake Inspection	X	X	X	X	X	X
	B-3	*Exhaust System Check	X	X	X	X	X	X
	B-4	Suspension and Steering Check	X	X	X	X	X	X
	B-5	Brake and Power Steering Check	X	X	X	X	X	X
Every 12 Months or 15,000 Miles	B-6	*Drive Belt Check		X		X		X
	B-7	Drum Brake and Parking Brake Check		X		X		X
	B-8	Throttle Linkage Check		X		X		X
	B-9	Underbody Flush & Check		X		X		X
	B-10	Bumper Check		X		X		X
Section C – Emission Control Maintenance								
At First 6 Months or 7,500 Miles – Then at 18 Month/ 22,500 Mile Intervals as Indicated in Log	C-1	Air Cleaner Check	X		X			X
	C-2	Carburetor Choke (Except Fuel Injection)	X		X			X
	C-3	Engine Idle Speed Adjustments	X		X			X
	C-4	EFE System Check (Except Fuel Injection)	X		X			X
	C-5	Carburetor (Or Fuel Injection Throttle Body) Mounting Torque	X		X			X
	C-6	Vacuum Advance System & Hoses Check	X		X			X
Every 12 Months or 15,000 Miles	C-7	Fuel Filter Replacement		X		X		X
	C-8	PCV System Check & Filter Service		X		X		X
		– PCV Valve Replacement				X		
Every 18 Months or 22,500 Miles	C-9	Spark Plug Wires Check			X			X
Every 22,500 Miles	C-10	Spark Plug Replacement			X			X
	C-11	Engine Timing Adjustment & Dist. Check			X			X
Every 24 Months or 30,000 Miles	C-12	ECS System Check & Filter Replacement				X		
	C-13	Fuel Cap, Tank and Lines Check				X		
Every 30,000 Miles	C-14	Air Cleaner Element Replacement				X		

•Also A Safety Service *Also An Emission Control Service

rotated at first 7,500 miles and then at every 15,000 miles thereafter. To equalize wear, rotate tires as illustrated in Owner's Manual and adjust tire pressures as shown on tire placard on glove box door.

A-6 REAR AXLE – Change lubricant at first 15,000 miles on controlled differential axles. Change lubricant every 7,500 miles on all type rear axles or final drives when using vehicle to tow a trailer.

A-7 AIR CONDITIONING – Check condition of air conditioning system hoses and refrigerant charge at sight glass. Replace hoses and/or refrigerant if need is indicated.

A-8 COOLING SYSTEM* – At 12-month or 15,000-mile intervals, wash radiator cap and filler neck with clean water, pressure test system and radiator cap for proper pressure holding capacity, tighten hose

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BACK TO INDEX

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clamps, and inspect condition of all cooling and heater hoses. Replace hoses if checked, swollen or otherwise deteriorated.

Also each 12 months or 15,000 miles clean exterior of radiator core and air conditioning condenser. Every 24 months or 30,000 miles, drain, flush, and refill the cooling system with a new coolant solution as described in your Owner's Manual.

A-9 WHEEL BEARINGS – Clean and repack front wheel bearings (rear on Eldorado) with a lubricant as specified in the "Recommended Fluids & Lubricants" chart in this folder at time of major axle or brake service.

A-10 FINAL DRIVE AXLE BOOTS AND OUTPUT SHAFT SEALS (Eldorado only) – Check for damaged, torn or leaking output shaft seal. Replace damaged parts as necessary.

A-11 AUTOMATIC TRANSMISSION FLUID* – Under normal driving conditions, change the transmission fluid and filter every 100,000 miles.

Under unusual conditions such as constant driving in heavy city traffic, trailer towing, and commercial applications, services should be performed at 50,000-mile intervals. See your Owner's Manual for further details on transmission care.

Section B
Safety Maintenance

B-1 (NOTE: Items B-1 (a) thru (w) can be checked by the owner, while Items B-2 thru B-10 should only be checked by a qualified mechanic. It is particularly important that any safety systems which may have been adversely affected in an accident be checked and repaired as necessary before the vehicle is returned to use.

SAFETY CHECKS TO BE PERFORMED BY OWNER – The following checks should be made regularly during operation at no greater interval than 6 months or 7,500 miles, whichever occurs first, and more often when the need is indicated. Any deficiencies should be brought to the attention of your dealer or another service outlet, as soon as possible, so the advice of a qualified mechanic is available regarding the need for repairs or replacements.

A. STEERING COLUMN LOCK – Check for proper operation by attempting to turn key to LOCK position in the various transmission gear ranges when the car is stationary. Key should turn to LOCK position only when transmission control is in PARK. Key should be removable only in LOCK position.

B. PARKING BRAKE AND TRANSMISSION "PARK" MECHANISM – Check parking brake holding ability by parking on a fairly steep hill and restraining the vehicle with the parking brake only. Check the holding ability of the automatic transmission "PARK" mechanism by releasing all brakes after the transmission selector lever has been placed in the "P" position.

CAUTION: Before making check "C", be sure to have a clear distance ahead of and behind the car, set the parking brake and firmly apply the foot brake. Do not depress accelerator pedal. Be prepared to turn off ignition switch immediately if engine should start.

C. STARTER SAFETY MECHANISM – Check starter safety mechanism by attempting to start the engine with the transmission in each of the driving gears. The starter should operate only in the Park ("P") or Neutral ("N") positions.

D. TRANSMISSION SHIFT INDICATOR – Check to be sure automatic transmission shift indicator accurately indicates the shift position selected.

E. STEERING – Be alert to any changes in steering action. The need for inspection or servicing may be indicated by increased effort to turn the steering wheel, excessive free play or unusual sounds when turning or parking.

F. WHEEL ALIGNMENT AND BALANCE – In addition to uneven or abnormal tire wear, the need for wheel alignment service may be indicated by a pull to the right or left when driving on a straight and level road. The need for wheel balancing is usually indicated by a vibration of the steering wheel or seat while driving at normal highway speeds.

G. BRAKES – Be alert to illumination of the brake warning light or changes in braking action, such as repeated pulling to one side, unusual sounds either when braking or between brake applications, or increased brake pedal travel. Any of these could indicate the need for brake system inspection and/or service.

H. EXHAUST SYSTEM – Be alert to any change in the sound of the exhaust system or a smell of fumes which may indicate a leak requiring inspection and/or service. (See also Engine Exhaust Gas Caution in Owner's Manual and item B-3 in this folder.)

I. WINDSHIELD WIPERS AND WASHERS – Check operation of wipers, as well as condition and alignment of wiper blades. Check amount and direction of fluid sprayed by washers during use.

J. DEFROSTERS – Check performance by moving control to "DEF" and noting amount of air directed against the windshield.

K. REARVIEW MIRRORS AND SUN VISORS – Check friction joints for proper adjustment so mirrors and sun visors stay in the selected position.

L. HORN – Blow the horn occasionally to be sure that it works. Check all horn actuating areas of horn pad.

M. LAP AND SHOULDER BELTS – Check belts, buckles, latch plates, retractors, reminder systems, guide loops, clips, and anchors for proper operation or damage. Check to make certain that anchor mounting bolts are tight.

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BACK TO INDEX

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N. SEAT ADJUSTERS – Check that seat adjusters securely engage by pushing forward and backward whenever a manual seat is adjusted.

O. HEAD RESTRAINTS – Check that head restraints adjust properly in the up detent positions, and that no components are missing, damaged or loose.

P. SEAT BACK RECLINER – Check to see that the seat back recliner is holding by pushing and pulling the top of the reclining seat back.

Q. SEAT BACK LATCHES – Check to see that seat back latches are holding by pulling forward on the top of each folding seat back (with doors closed).

R. LIGHTS AND CHIMES OR BUZZERS – Check all instrument panel illuminating and warning lights, seat belt reminder light and chime or buzzer, ignition key buzzer, interior lights, license plate lights, side marker lights, headlamps, parking lamps, tail lamps, brake lights, turn signals, backup lamps, and hazard warning flashers. Have headlmap aim checked every 12 months or 15,000 miles, or more often if light beams seem to be aimed improperly.

S. GLASS – Check for broken, scratched, dirty or damaged glass on vehicle that could obscure vision or become an injury hazard.

T. DOOR LATCHES – Check for positive closing, latching and locking.

U. HOOD LATCHES – Check to make sure hood closes firmly by lifting on the hood after each closing. Check also for broken, damaged or missing parts which might prevent secure latching. Check to make sure secondary latch hook is engaging properly when hood is propped open.

V. FLUID LEAKS – Check for fuel, water, oil or other fluid leaks by observing the ground beneath the vehicle after it has been parked for a while. (Water dripping from air conditioning system after use is normal.) If gasoline fumes or fluid are noticed at any time, the cause should be determined and corrected without delay because of the possibility of fire.

W. SPARE AND JACK – Check that the spare tire assembly and jack equipment are securely stowed at all times.

B-2 TIRES AND WHEELS – Adjust tire pressures as recommended on tire placard on glove box door. Check disc brake pads and condition of rotors while wheels are removed. Check tires for excessive wear or damage. Make certain wheels are not bent or cracked and wheel nuts are tightened to the torque range specified in the Owner's Manual. Check tire inflation pressure at least monthly, or more often if daily visual inspection indicates the need.

B-3 EXHAUST SYSTEM* – Check complete exhaust system and nearby body areas and trunk lid for broken, damaged, missing or mispositioned parts, open seams, holes, loose connections or other deterioration which could permit exhaust fumes to seep into the trunk or passenger compartment. Dust or water in the trunk may be an indication of a problem in one of these areas. Any problems should be corrected immediately. To help continue integrity, exhaust system components rearward of the muffler must be replaced whenever a new muffler is installed.

B-4 SUSPENSION AND STEERING – Check for damaged, loose or missing parts, or parts showing visible signs of excessive wear or lack of lubrication in front and rear suspension and steering system. Malfunctioning parts noted should be replaced by a qualified mechanic without delay.

B-5 BRAKES AND POWER STEERING – Check lines and hoses for proper attachment, leaks, cracks, chafing, deterioration, etc. Any malfunctioning parts noted should be replaced or repaired immediately. When abrasion or wear is evident on lines or hoses, the cause must be corrected.

B-6 ENGINE DRIVE BELTS* – Check belts driving fan, AIR pump, generator, power steering pump, and air conditioning compressor for cracks, fraying, wear and tension. Adjust or replace as necessary.

B-7 DRUM BRAKES AND PARKING BRAKE – (See Item B-2 for disc brake check.) Check drum brake linings and other internal brake components at each wheel (drums, wheel cylinders, etc.). Parking brake adjustment also should be checked whenever drum brake linings are checked.

(NOTE: More frequent brake checks should be made if driving conditions and habits result in frequent brake application.)

B-8 THROTTLE LINKAGE – Check for damaged or missing parts, interference or binding. Any deficiencies should be corrected without delay by a qualified mechanic.

B-9 UNDERBODY – In geographic areas using a heavy concentration of road salt or other corrosive materials for snow removal or road dust control, flush and inspect the complete underside of the car at least once each year, preferably after a winter's exposure. Particular attention should be given to cleaning out underbody members where dirt and other foreign materials have collected.

B-10 BUMPERS – Check the front and rear bumper systems at 12-month/15,000-mile intervals to be sure that impact protection and clearance originally designed into these systems remain in a state of full readiness. They also should be checked whenever there is obvious bumper misalignment, or whenever the vehicle has been involved in a significant collision in which the bumpers were struck, even when slight or no damage to the bumper systems can be seen.

Section C
Emission Control Maintenance

(NOTE: Additional recommended maintenance instructions relating to vehicle use, evidence of maintenance, and service replacement parts are included in the New Car Warranty Information folder.)

C-1 AIR CLEANER – Inspect installation to make certain that all hoses and ducts are connected and

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BACK TO INDEX

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correctly installed. Also check valve for proper operation. (Except fuel injected cars.)

C-2 CARBURETOR CHOKE, WIRE, LINKAGES, AND HOSES (Except fuel injected cars) – Check choke mechanism for proper operation. Any binding condition which may have developed due to petroleum gum formation on the choke shaft or from damage should be corrected. Check carburetor choke wire and hoses for proper connection, cracking, abrasion or deterioration and vacuum break units for operation and correct or replace as necessary.

C-3 ENGINE IDLE SPEEDS – Adjust engine idle speeds accurately (following the specifications shown on the label under the hood). Adjustments must be made with test equipment known to be accurate.

C-4 EARLY FUEL EVAPORATION (EFE) SYSTEM (Except fuel injected cars) – Check valve for proper operation. A binding condition must be corrected. Check switch for proper operation. Check hoses for cracking, abrasion or deterioration. Replace parts as necessary.

C-5 CARBURETOR (OR THROTTLE BODY) MOUNTING – At 7,500, 22,500, and 45,000 miles, or at indicated time intervals, torque carburetor (or fuel injection throttle body) attaching screws to compensate for compression of the gasket.

C-6 VACUUM ADVANCE SYSTEM AND HOSES – Check system for proper operation and hoses for proper connection, cracking, abrasion or deterioration. Replace parts as necessary.

C-7 FUEL FILTER – Replace filter at 12-month/15,000 mile intervals or more frequently if clogged. The fuel filter is located in the carburetor (except on cars equipped with fuel injection). On the Seville, the filter is located under the body forward and inboard of the left rear wheel, and on the lower left front side of the engine on other cars with fuel injection.

C-8 POSITIVE CRANKCASE VENTILATION SYSTEM (PCV) – Check the PCV system for satisfactory operation at 12-month/15,000-mile intervals, and clean filter (in crankcase breather). Replace the PCV valve at 24-Month/30,000-mile intervals and blow out PCV valve hose with compressed air. Replace deteriorated hoses.

C-9 SPARK PLUG WIRES – Clean exterior of wires; remove any evidence of corrosion on end terminals. Inspect spark plug wires for evidence of checking, burning, or cracking of exterior insulation and tight fit at distributor cap and spark plugs or other deterioration. If corrosion cannot be removed or other conditions above are noted, replace wire.

C-10 SPARK PLUGS – Replace plugs at 22,500-mile intervals with type specified in Owner's Manual.

C-11 TIMING AND DISTRIBUTOR CAP – Adjust ignition timing following the specifications shown on label under the hood. Also, carefully inspect the interior and exterior of the distributor cap and rotor for cracks, carbon tracking and terminal corrosion. Clean or replace as necessary.

C-12 EVAPORATION CONTROL SYSTEM (ECS) – Check all fuel and vapor lines and hoses for proper connections and correct routing as well as condition. Remove canister and check for cracks or damage. Replace damaged or deteriorated parts as necessary. Replace filter in lower section of canister.

C-13 FUEL CAP, FUEL LINES AND FUEL TANK – Inspect the fuel tank, cap and fuel lines for damage which could cause leakage. Inspect fuel cap for correct sealing ability and indications of physical damage. Replace any damaged or malfunctioning parts.

C-14 AIR CLEANER ELEMENT – Replace the engine air cleaner element under normal operation conditions every 30,000-miles. Operation of vehicle in dusty areas will necessitate more frequent replacements. Your dealer can be of assistance in determining the proper replacement frequency for the conditions under which you operate your vehicle.

CAUTION: Do not operate the engine without the air cleaner unless temporary removal is necessary during repair or maintenance of the vehicle. When the cleaner is removed, backfiring can cause fire in the engine compartment.

Recommended Fluids & Lubricants

USAGE	FLUID/LUBRICANT
Engine fuel	ONLY Unleaded fuel of at least 91 Research Octane. Refer to Owner's Manual for additional information.
Engine oil	High Quality engine oils rated "SE". Refer to Owner's Manual for oil viscosity recommendation and further information.
Power steering (Hydra-Boost if equipped) system and pump reservoir	GM power steering fluid Part No. 1050017–if not available use DEXRON® II automatic transmission fluid
Differential–standard	SAE-80W or SAE-80W-90 GL-5 gear lubricant (SAE-80W in Canada)
Differential–controlled	Lubricant GM Part No. 1050189 for standard Cadillacs, 1050081 for Seville
Brake system & master cylinder	Delco Supreme 11 fluid or DOT-3
Hood Latch Assembly	
a. Pivots and spring anchor	Engine oil
b. Release pawl	Chassis grease
Hood hinges	Engine oil
Hood rear bumpers	Engine oil
Hood rear bumpers	Moly disulfide lubricant
Automatic transmission shift linkage	Engine oil
Chassis lubrication	Chassis grease meeting GM 6031-M
Automatic transmission	DEXRON®II automatic transmission fluid

BACK TO INDEX

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Parking brake cables	Chassis grease
Front wheel bearings (rear on Eldorado)	#2 grade lithium high melting point wheel bearing grease. GM Part No. 105 0679
Body door hinge pins, fuel door hinge, rear compartment lid hinges	Engine oil
Convertible door to lock wedge plates	Stick-type lubricant
Windshield washer solvent	GM Optikleen washer solvent Part No. 1051515 or equivalent
Engine coolant	Mixture of water and a high quality Ethylene Glycol base type anti-freeze conforming to GM Spec. 1899-M
EFE valve	Manifold heat valve lubricant GM Part No. 1050422
Air conditioning system	Refrigerant "12" and 525 viscosity refrigeration oil

NOTE: Fluids and lubricants identified with GM part numbers of GM specification numbers may be obtained from your Cadillac dealer.

ENGINE OIL CHANGE INTERVAL AND VISCOSITY CHART

ENGINE OIL RECOMMENDATION

Use only high quality oils intended for service "SE". The chart below will serve as a guide for selecting proper oil viscosity. Change oil every 6 months never to exceed 7,500 miles.
Change oil each 3 months or 3,000 miles, whichever occurs first, under the following conditions: Driving in dusty areas, trailer towing, extensive idling, short trip operation (engine not thoroughly warmed up) or sustaines high temperatures.

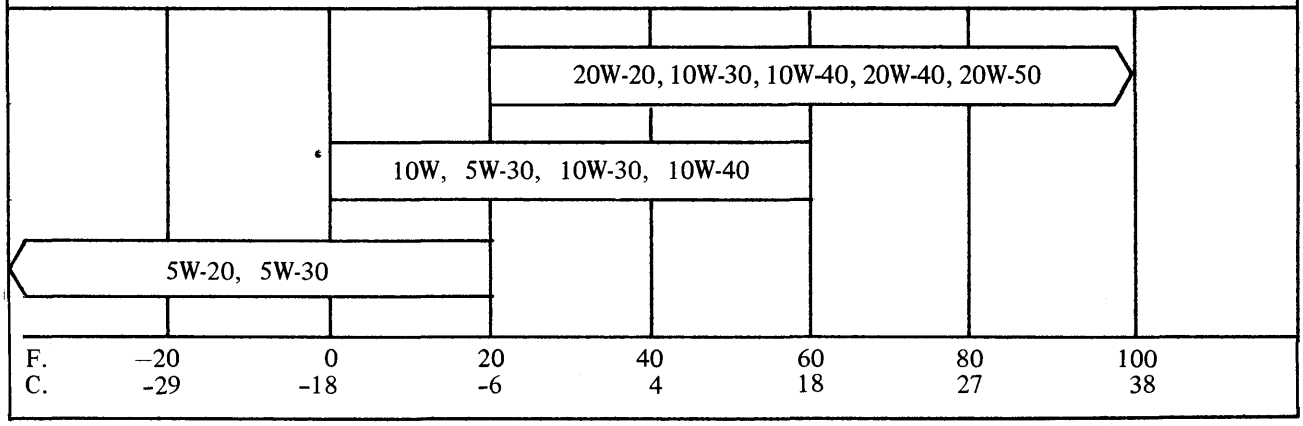
OIL VISCOSITY PRECAUTIONS

SAE 5W-20 oils are not recommended for sustained high-speed driving.

SAE 30 oils may be used at temperatures above 40°F. (4°C.).

SAE 5W-30 viscosity oils recommended for vehicles normally operated in Canada.

Recommended SAE Viscosity Number



Temperature range anticipated before next oil change, °F.

BACK TO INDEX

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FLUID CAPACITIES

All Series Unless Otherwise Noted	U.S. Measure	Imperial Measure	Metric Measure
Engine Oil			
All (Except Eldorado)	4 Quarts	3-1/3 Quarts	3.8 Liters
Eldorado Only	5 Quarts	4-1/6 Quarts	4.7 Liters
When Filter is Changed			
All (Except Eldorado)	5 Quarts	4-1/6 Quarts	4.7 Liters
Eldorado Only	6 Quarts	5 Quarts	5.7 Liters
Cooling System			
All (Except Eldorado)	23.0 Quarts	18-3/4 Quarts	21.8 Liters
Eldorado	25.8 Quarts	20 Quarts	24.4 Liters
Air Conditioner - Refrigerant 12	3-3/4 Pounds	3-3/4 Pounds	1.7 Kilograms
75 Series Only	5 Pounds	5 Pounds	2.3 Kilograms
Air Conditioner Compressor Oil -			
525 Viscosity	10-1/2 Fluid Ounces	8-3/4 Ounces	297.7 Grams
75 Series Only	13-1/2 Fluid Ounces	11-1/4 Ounces	382.7 Grams
Rear Axle (Except Eldorado)	4 Pints	3-1/3 Pints	1.9 Liters
Final Drive (Eldorado Only)	4 Pints	3-1/3 Pints	1.9 Liters
Gasoline Tank (All Series)	27.5 Gallons (Approx.)	23 Gallons (Approx.)	104.1 Liters (Approx.)
Turbo-Hydra-matic Transmission (Except 693)			
Dry	12 Quarts, 1 Pint	10-1/3 Quarts	11.8 Liters
Pan and Filter Removed	4 Quarts	3-1/3 Quarts	3.8 Liters
(Eldorado Only)			
Dry	13 Quarts	10-5/6 Quarts	12.3 Liters
Pan and Filter Removed	5 Quarts	4-1/6 Quarts	4.7 Liters

*5 Pints w/3.15:1 Rear Axle Ratio

BACK TO INDEX

DAVE GRAHAM AUTO LITERATURE, INC.
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TABLE OF CONTENTS

Subject	Page No.
GENERAL INFORMATION	1-2
THEORY OF OPERATION — FRONT AIR CONDITIONER	
Air Delivery System	1-2
Refrigeration System	1-5
Automatic Temperature Control System	1-10
DIAGNOSIS OF PROBLEMS	
How to Isolate the Problem	1-39
Temperature Control Problems	1-41
Blower Control Problems	1-47
Auxiliary Vacuum and Electrical Problems	1-49
Refrigeration Problems	1-51
Use of the ATC Tester	1-54
SERVICE INFORMATION	
Handling Refrigerant and Refrigerant Components	1-55
Maintenance and Inspection	1-57
Checking Refrigerant Charge	1-58
Purging, Evacuating and Charging	1-58
Temperature Dial Calibration	1-62
Air-Mix Door Link Adjustment	1-62
Vacuum Circuits	1-23
Electrical Circuits	1-65
Removal and Installation Procedures	
Compressor	1-64
Evaporator	1-64
EEVIR	1-66
ATC Programmer	1-71
Compressor Overhaul	1-75
Programmer Overhaul	1-99
FLEETWOOD SEVENTY-FIVE — REAR AIR CONDITIONER	
Theory of Operation	1-102
Service Information	1-109
SPECIAL TOOLS	1-120
TORQUE SPECIFICATIONS	1-121
VACUUM CIRCUIT DIAGRAM — COMPLETE	REAR GATEFOLD

BACK TO INDEX

DAVE GRAHAM AUTO LITERATURE, INC.
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GENERAL INFORMATION

Changes in the climate control system for 1976 include the following:

1. Plastic Control Head
2. Elimination of Lo Blower Relay
3. Small Diameter High Pressure Fitting (3/8-24) on all cars.
4. Teflon Compressor Piston Rings

Wiring and circuit board changes are incorporated which make the control head specific to 1976 cars.

The climate control wiring is significantly simplified by the elimination of the Lo Blower relay. Immediate turn on regardless of ambient temperature in "Off" and "Lo" are the only functional differences. ATC Tester J-23678 with instructions J-23678-50A will continue to be used.

Shortly after the start of production the high pressure fitting will be changed from the 7/16-20 thread size to the smaller 3/8-24 that is used on cars equipped with Electronic Fuel Injection. Adapter J-25498 is required when servicing a car equipped with the smaller fitting.

Compressor piston rings are teflon instead of the cast iron hook-type. Special tools J-24608-1, -2, -3, -5 and -6 are available to service teflon piston rings. Complete piston and ring assemblies are also available.

Automatic Temperature Control (ATC) is standard equipment on all cars. The front system is the same for all series, with the exception of specific refrigeration hoses for Eldorados, fuel injected cars and Fleetwood Seventy-Fives. Seventy-Five Series cars are equipped with a rear heating and air conditioning temperature control system which operates completely independent of the front system. It is "teed" into the front system at the heater water and refrigerant feed and return lines. This section contains information on the front systems. Information on the Series 75 system is contained in the last part of this section; see Table of Contents.

The location of most of the air conditioner components is shown in Fig. 1-1. The information on theory of operation that follows will cover the air delivery system, the refrigeration system and the automatic temperature control system.

THEORY OF OPERATION

FRONT AIR CONDITIONER — ALL SERIES

Air Delivery System

In normal operation, air utilized by the system is drawn into the body air plenum through openings at the base of the windshield and directed to the air inlet which is located inside the plenum on the right side of the body. From the air inlet, the air enters the blower which directs it through the evaporator where it is filtered, dehumidified and cooled to approximately 35°F. (2°C.). It is then "reheated" as required by being passed through and around the heater core. This air is then directed by air doors in the heater assembly to the air conditioner outlets in the instrument panel, to the heater distributor at floor level or to the defroster outlets. Air exhausts from the body by passing through the air exhaust grilles located in the door lock pillars. This provides positive air flow even when windows are closed. The components comprising the air delivery system are listed and described below.

a. Air Inlet

The air inlet which is attached to the rear surface of the blower scroll and located inside the body air intake plenum is composed of a plastic housing, an air door and a vacuum actuator that controls the position of the door. See Fig. 1-2. The door has two positions – with no vacuum applied to the actuator, the door is in a rearward position, blocking off the recirculating air opening and allowing only outside air to enter the blower. When vacuum is applied to the actuator, the door is moved to a forward position where it blocks most of the outside air and allows approximately 80% of the total air supply to be recirculated from the passenger compartment.

b. Blower and Evaporator

The blower and evaporator, shown in Fig. 1-2, is located in the engine compartment on the right side of the cowl. This assembly consists of a plastic housing, a squirrel-cage type blower, the evaporator core and two refrigerant control valves.

The evaporator core, which is aluminum and similar in construction to the car radiator, is the actual cooling unit of the system. The blower draws air from the air inlet and forces it through the evaporator core where it is cooled and dehumidified. Condensate is allowed to drain from the housing through a small hole in the bottom. The blower is air cooled – a small portion of blower output air is recirculated through the motor housing via a rubber tube.

c. Heater

This assembly, shown in Fig. 1-3, is located inside the passenger compartment under the right-hand side of the instrument panel. It consists of a sheet metal and plastic housing, a heater core, an air-mix door which is controlled by the ATC (automatic temperature control) programmer, an upper and a lower mode door, each controlled by a vacuum actuator, and a defroster door which is controlled by a two-stage vacuum actuator.

BACK TO INDEX

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Cold, dehumidified air from the evaporator enters this assembly through an opening in the dash panel and is reheated, as required, by the heater core. The air-mix door controls the amount of reheat that takes place. In one of its end positions it forces all the air from the evaporator to flow through the hot heater core – the resulting air stream is very hot. In the extreme opposite position, the door forces all the air to bypass around the

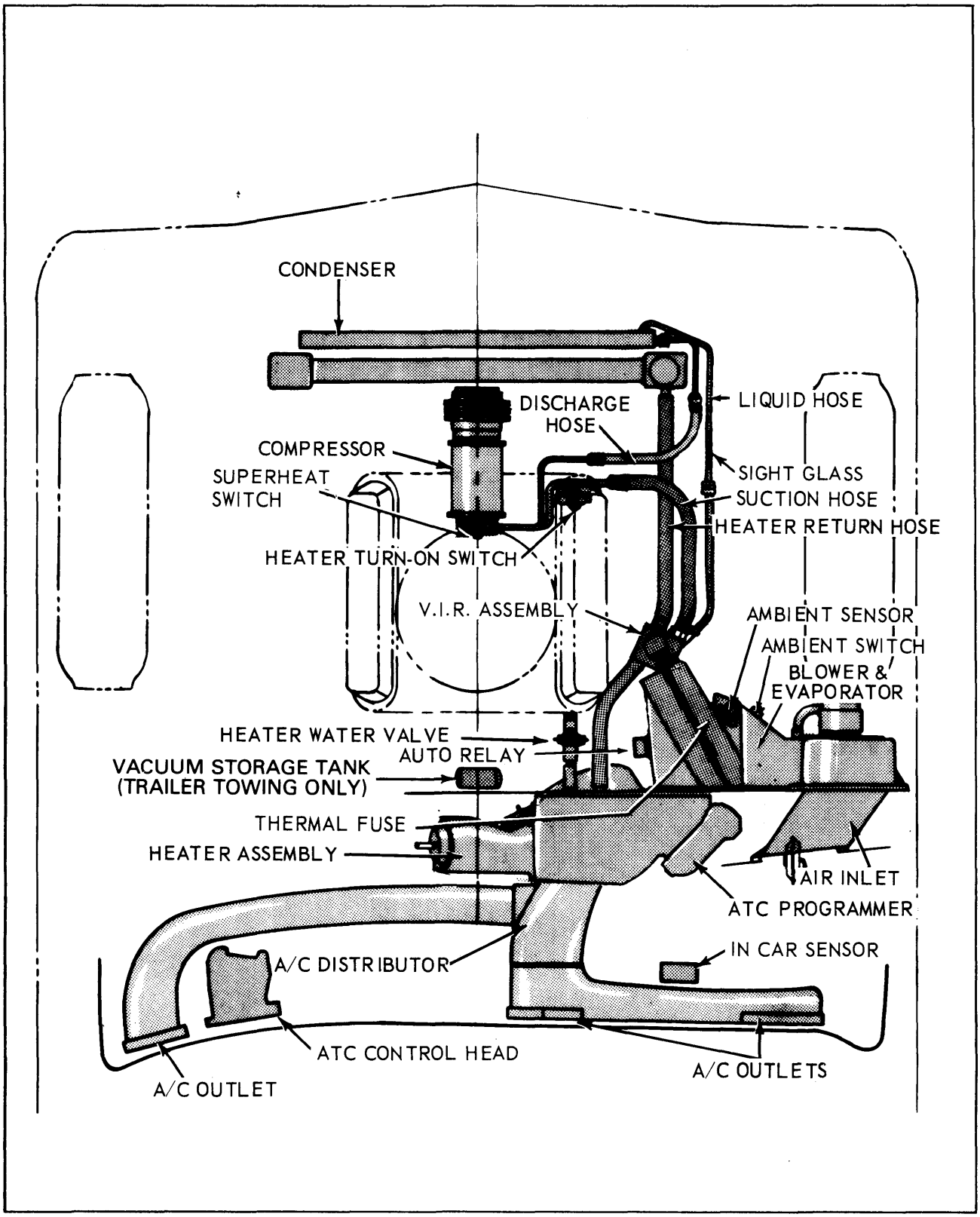


Fig. 1-1 Location of Air Conditioner Components

BACK TO INDEX

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heater core so that no reheat takes place and the resulting air stream is very cold. In intermediate positions, some of the air passes through the heater core and some bypasses it, so that the resulting air stream is mixed to the desired temperature.

The air stream is next directed by two mode doors so that it either flows out an opening in the rear surface of the heater case and into the A/C distributor or it continues to flow to the left toward the heater distributor. The two mode doors operate in unison most of the time, causing air to be discharged either from A/C outlets or from the deater distributor; however, when the control head lever is set at "Bi-Level", the upper mode door is not actuated and allows part of the air stream to continue on to the heater distributor while the lower mode door is actuated and positions itself to cause the remainder of the air stream to enter the A/C distributor and be delivered from the A/C outlets. This type of air delivery is referred to as bi-level air delivery.

The defroster door located at the left-hand end of the heater is operated by a two-stage vacuum actuator and has three positions. With vacuum applied to the side port of the actuator, the door is pulled down slightly so that it intercepts only a small amount of air to be diverted to the defroster outlet. When vacuum is applied to both the side and center ports, the door is pulled full down and intercepts most of the air that would normally go to the heater distributor.

d. Air Conditioner Distributor

The A/C distributor is a large plastic duct attached to the rear surface of the heater. It receives air from the heater and distributes it to the left-hand center and right-hand A/C outlets through flexible air hoses and plastic ducts to the outlets, Fig. 1-3.

e. Air Conditioner Outlets

Four outlets, Fig. 12-53, are located in the instrument panel; one at the left side of the cluster. Two in the center of the pad and one at the right-hand side. Each outlet provides an air stream whose direction can be controlled independently. The outlet may be rotated to provide a vertical air adjustment while the knob is used to provide horizontal adjustment. Air flow may be stopped altogether from each outlet by moving the shut-off knob beneath each outlet.

A moderate flow of cool air to the floor is provided by two small plastic outlets located on the sides of the A/C distributor (Fig. 1-3). The right hand outlet can be rotated to obtain a more indirect flow of air to the floor area, if desired.

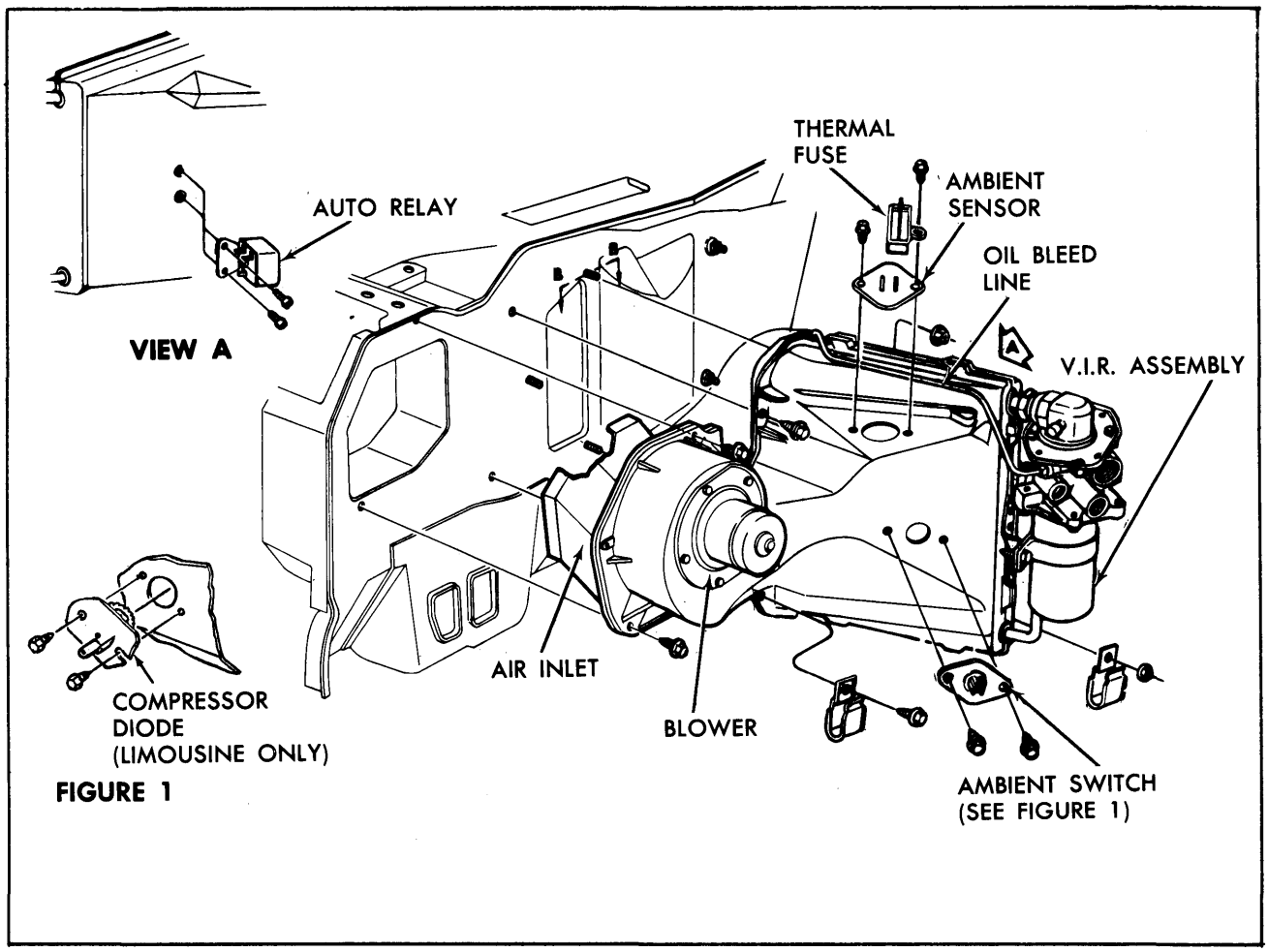


Fig. 1-2 Air Inlet, Blower and Evaporator

BACK TO INDEX

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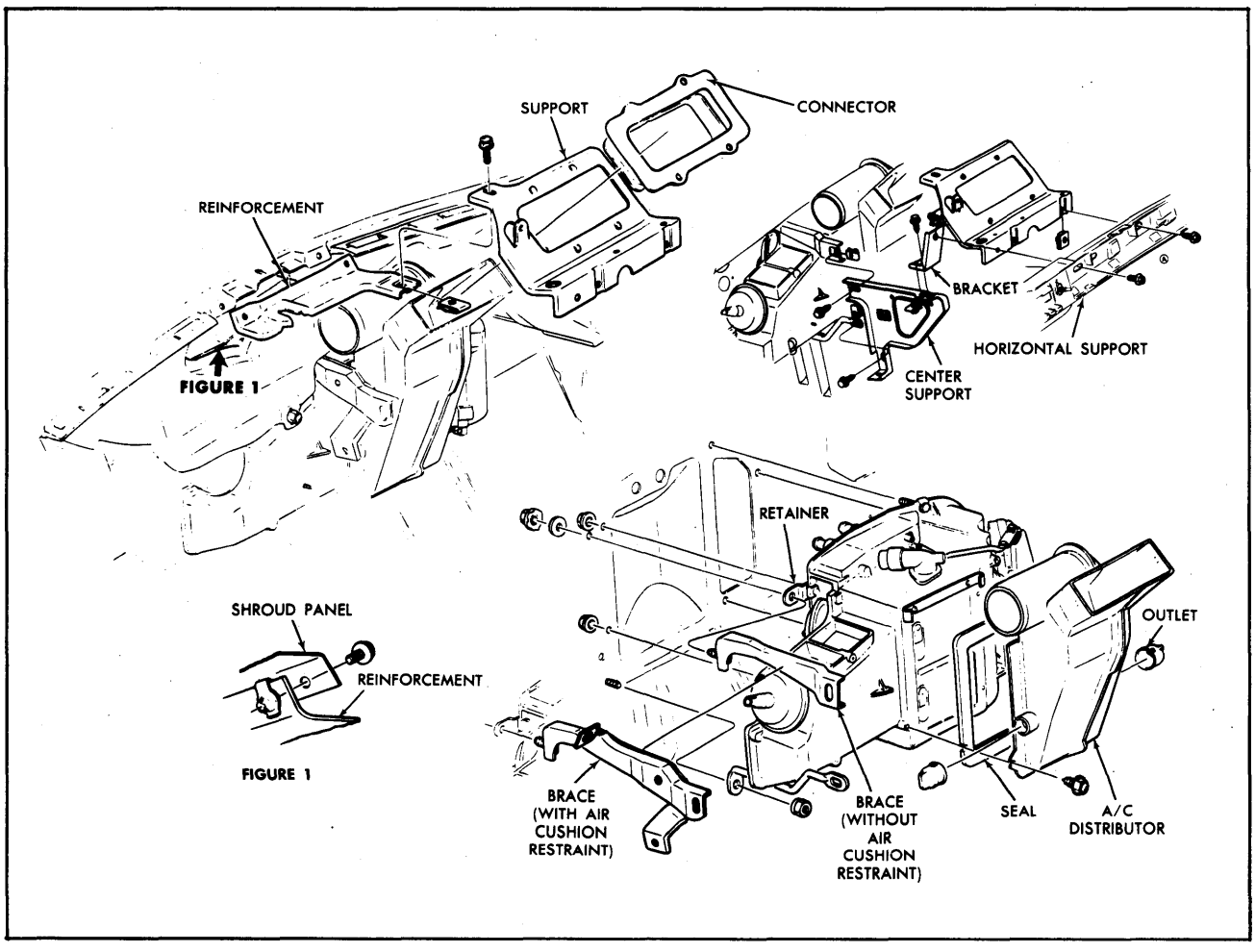


Fig. 1-3 Heater Assembly

f. Heater Outlet

The heater outlet, (See Fig. 1-3) is attached to the bottom surface of the heater case at centerline of car. It distributes air to the left-hand and right-hand sides of the front floor and also directs two heavy streams of air under the front seat to heat the rear compartment.

g. Defroster Nozzle

A unitized defroster nozzle delivers defrosting air to both sides of the windshield. It is attached to the top of the heater case near centerline with one screw and to the lower windshield frame.

REFRIGERATION SYSTEM

The sole function of the refrigeration system is to maintain the evaporator core at approximately 32° (0°C.) when refrigeration is required. Four major components, interconnected by rubber hose and metal tubing, accomplish this – the compressor, the condenser, the VIR assembly and the evaporator core. Location of these parts is shown in Fig. 1-1. An explanation of the refrigeration circuit and a brief description of each component flows.

a. Refrigeration Cycle

Refer to Fig. 1-4 for a generalized schematic of the refrigeration system showing relationship of components. The compressor discharges high temperature, high pressure vapor that contains heat absorbed in the evaporator plus heat imparted to it by the compressor in the compression process. This vapor flows through two parallel tubes in the condenser where it releases heat to the airstream and changes to a medium temperature high pressure liquid. This liquid flows to the receiver section of the VIR; from there it flows past a sight glass and to the expansion valve. At the expansion valve, the medium temperature, high pressure liquid changes to a low temperature, low pressure liquid and vapor mixture. This cold, foamy mixture enters the evaporator core at the bottom end and flows through parallel tubes upward through the core. Heat from the warm airstream passing through the core is transferred to the refrigerant, vaporizing the liquid. Under high load conditions all the liquid is vaporized in the evaporator and only vapor flows through the suction throttling valve section of the VIR and the suction line to the compressor. The heat-laden vapor is drawn into the compressor and the cycle is repeated.

BACK TO INDEX

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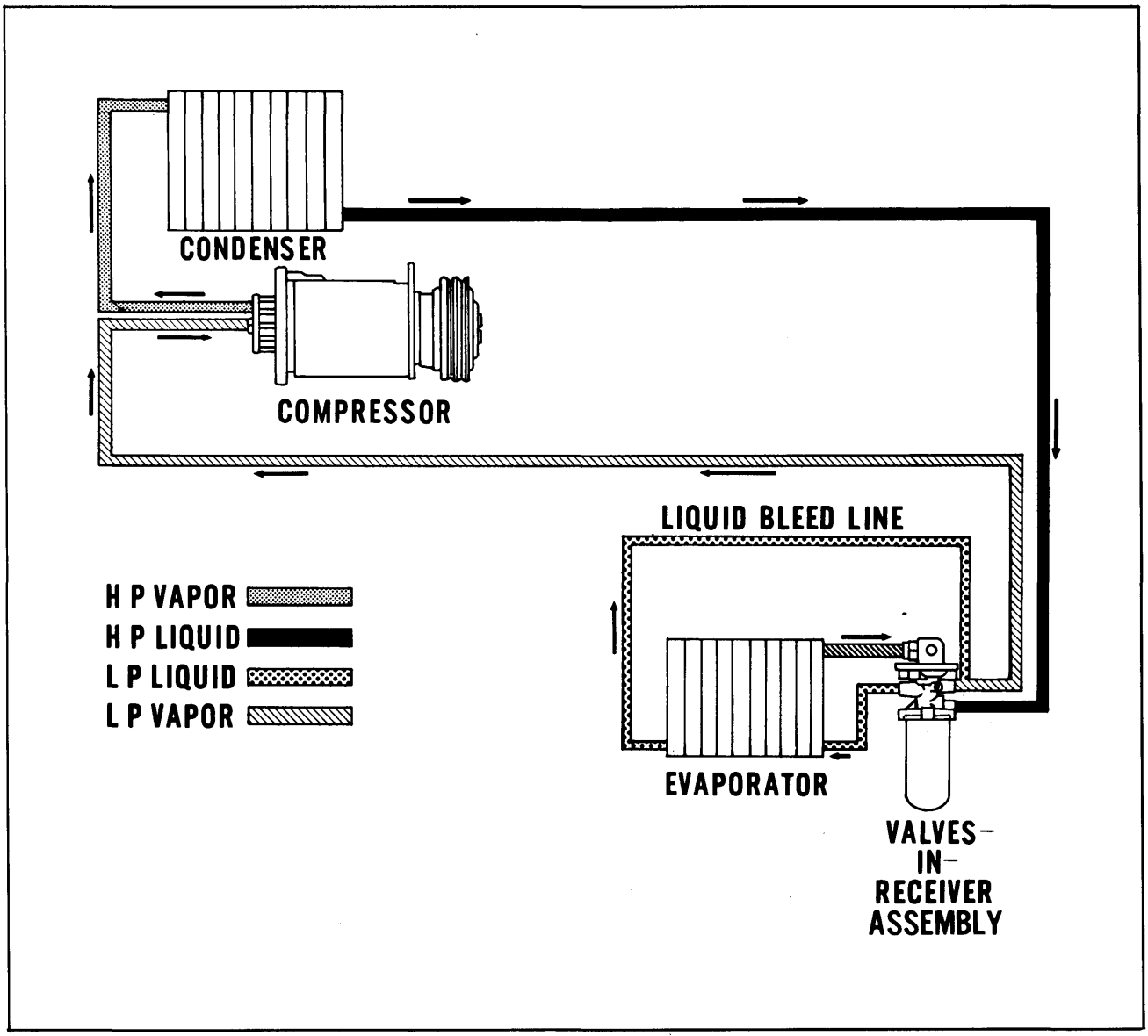


Fig. 1-4 Refrigerant Circuit

b. Compressor

The compressor, Fig. 1-5, is located on top of the engine near centerline and is belt driven from the crankshaft pulley. Its function is to pump refrigerant around the refrigeration circuit and to provide pressure and temperature levels at which heat exchange can take place. It utilizes three double-acting pistons positioned axially around the compressor shaft, each of which operate in a front and a rear cylinder assembly. The pistons are actuated by an axial plate that is pressed on the compressor shaft. The cylinders have a bore diameter of 1-1/2 inches and a stroke of 1-3/16 inches, providing a total piston displacement of 12.6 cubic inches. Suction and discharge valve plates are located at the forward end of the front cylinder block and at the rear of the rear cylinder block.

A magnetic clutch is used to drive the compressor shaft. When voltage is applied to the clutch coil, the clutch plate and hub assembly, which is solidly coupled to the compressor shaft, is drawn by magnetic force rearward toward the pulley which rotates freely on the front head casting. The magnetic force locks the clutch plate and pulley together as one unit. The compressor shaft then turns with the pulley. When voltage is removed from the clutch coil, springs in the clutch plate and hub assembly move the clutch plate away from the pulley and the clutch plate and compressor shaft cease to rotate.

c. Condenser

The Condenser is an aluminum tube-and-fin heat transfer unit located dirdctly forward of the radiator, Fig. 1-1. The function of the condenser is to transfer heat from the refrigerant flowing through its tube to the airstream drawn through it by the engine fan.

BACK TO INDEX

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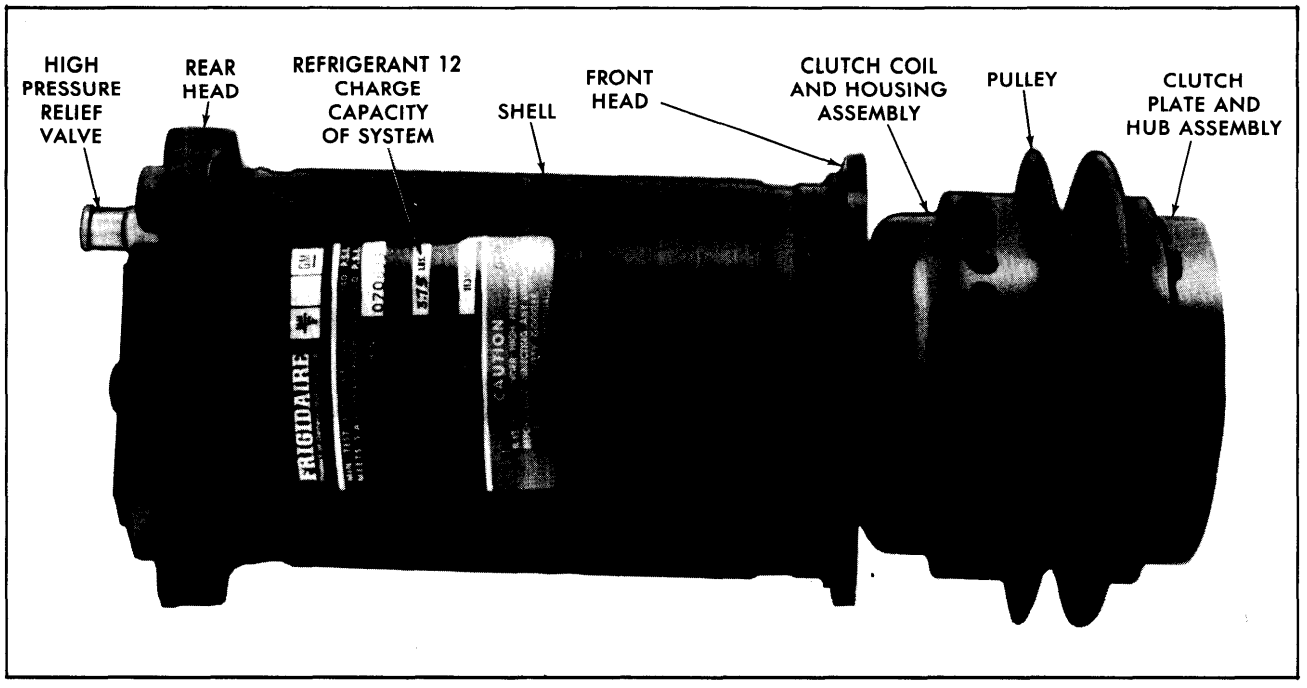


Fig. 1-5 Air Conditioner Compressor

d. Evaporator

The blower and evaporator, Fig. 1-2, is located in the engine compartment on the right side of the cowl. This assembly consists of a plastic housing, a squirrel-cage type blower, the evaporator core and also serves to mount the VIR assembly.

The evaporator core, which is aluminum and similar in construction to the car radiator, is the actual cooling unit of the system. The blower draws air from the air inlet and forces it through the evaporator core where it is cooled and dehumidified. Condensate is allowed to drain from the housing through a small hole in the bottom. The blower is air cooled – a small portion of blower output is recirculated through the blower housing through a small rubber hose.

The oil bleed line is a small diameter aluminum tube routed from the inlet tank of the evaporator core to a fitting on the side of the suction throttling valve cavity of the VIR assembly. This line serves to protect the compressor during periods of low refrigerant charge or flow. When refrigerant charge or flow is low, oil return to the compressor through the outlet pipe of the evaporator is greatly impaired; the oil bleed line acts as a bypass to assure that oil, mixed with liquid refrigerant 12, will be returned to the compressor.

A check valve is incorporated in the oil bleed line at the fitting on the VIR connector shell. This valve starts to open with 10 psi pressure differential across it and is fully open at 20 psi. Below 10 psi the check valve is closed to prevent loss of capacity. This feature prevents refrigerant from bypassing the evaporator core during traffic and low speed conditions when cooling demands are greatest.

e. Evaporator Equalized Valves-In-Receiver Assembly

The EEVIR assembly, Fig. 1-6, combines the thermostatic expansion valve (X-Valve), POA suction

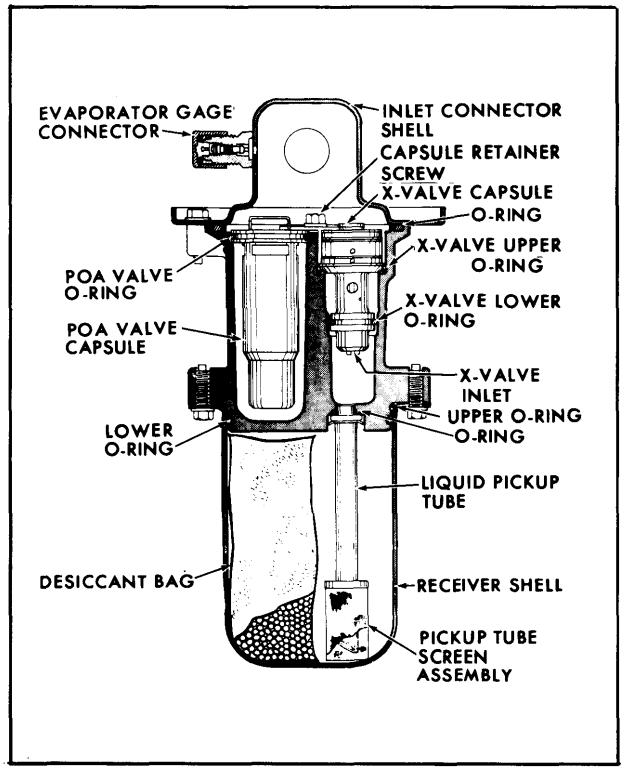


Fig. 1-6 EEVIR Assembly Cutaway View

BACK TO INDEX

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throttling valve (STV Valve), receiver-dehydrator and sight glass into one integral unit, mounted on the evaporator case. The liquid sight glass is located in the valve housing at the inlet end of the X-Valve cavity. The drier desiccant is replaceable by removing the receiver shell and replacing the bag. The X-Valve and STV valve capsules are replaceable by removing the inlet connector shell assembly at the top of the valve housing.

In operation, liquid refrigerant from the condenser flows into the liquid inlet port of the valve housing to the receiver where it can come in contact with the desiccant, Fig. 1-7. The liquid refrigerant flows directly from the receiver through the filter screen at the bottom of the liquid pickup tube, through the pickup tube to the lower portion of the X-Valve cavity. The X-Valve meters the liquid refrigerant to the evaporator.

Refrigerant vapor from the evaporator returns through the inlet connector shell assembly at the top of the VIR assembly and the STV valve then regulates the rate of refrigerant flow back to the compressor.

The evaporator gage fitting incorporates a Schrader type valve located in the inlet connector shell assembly at the top of the VIR unit. The oil bleed line fitting is located in the VIR valve housing and is connected directly into the STV valve cavity.

The refrigeration system incorporates the revised VIR system called the EEVIR (Evaporator Equalized Valves In Receiver) found in all 1976 Cadillacs. The EEVIR, Fig. 1-6 reduces the effect of air conditioning on fuel consumption.

There are two specific components of the EEVIR which must not be interchanged with previous design VIR parts. These are, (1) the valve housing, and (2) the expansion valve (X-valve capsule). Identification of the EEVIR housing is by the letter "E" cast on the side. The X-valve capsule for EEVIR is identified by its gold finish rather than the silver finish of the previous VIR part. No "O" ring is used in the top groove of an EEVIR X-Valve.

EEVIR Expansion Valve

The expansion valve, Fig. 1-8, is a pressure and temperature-sensitive, automatic valve used to control the amount of refrigerant entering the evaporator. The valve controls the flow of refrigerant by sensing the temperature and pressure of the refrigerant gas as it passes through the EEVIR unit on the return to the compressor. The refrigerant path is shown in Fig. 1-7.

The expansion valve cavity is divided into three separate pressure zones. The area below the bottom "O" ring is subjected to discharge or high side pressure. The area between the bottom "O" ring and the upper "O" ring corresponds to evaporator inlet pressure. The area above the upper "O" ring is evaporator outlet pressure.

The working part of the X-Valve is the power diaphragm. The diaphragm controls the position of the valve seat in response to four forces: (1) the *temperature* of the return refrigerant passing across the top and around the sides of the expansion valve on its way to the STV valve; (2) the *pressure* of the refrigerant acting on the bottom side of the diaphragm as it passes around the valve and enters the equalizer port; (3) head pressure acting on the bottom of the valve, and; (4) spring

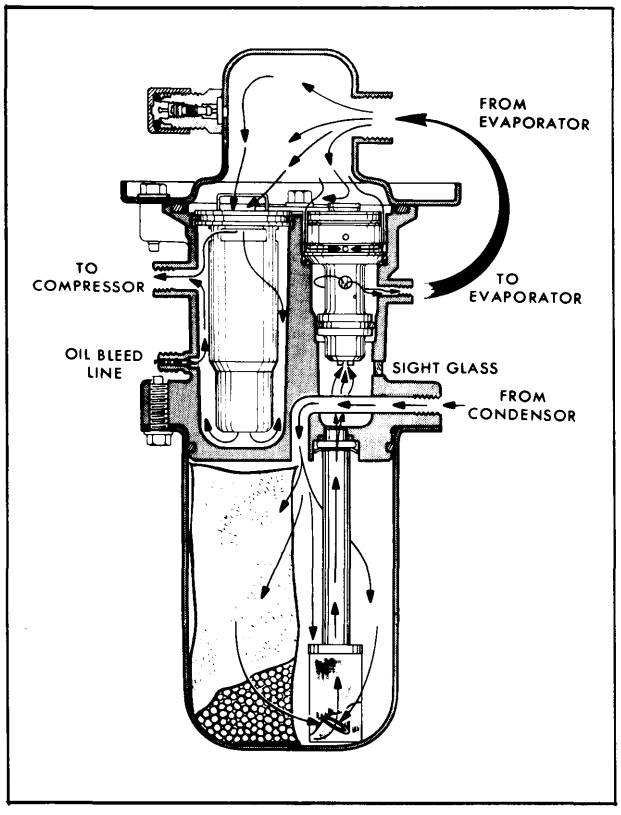


Fig. 1-7 Refrigerant Flow in EEVIR Assembly

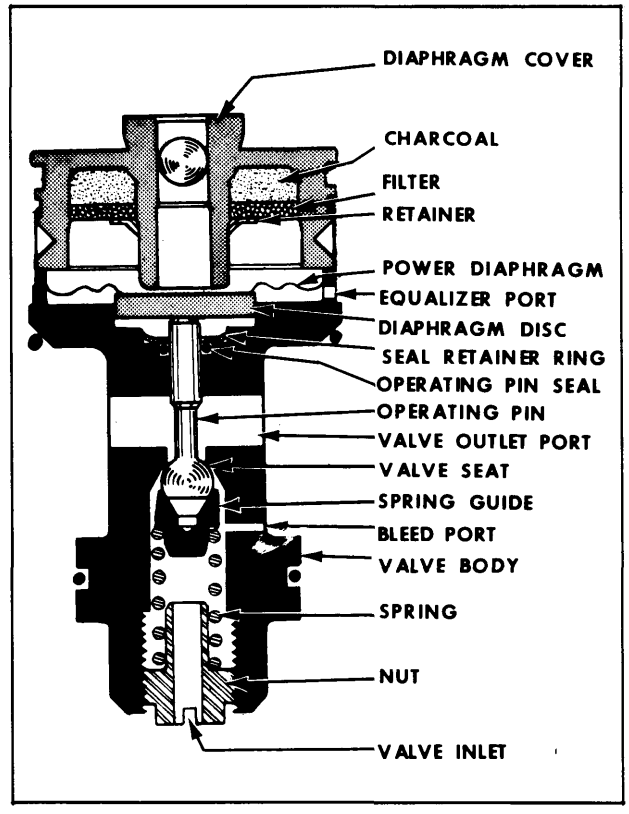


Fig. 1-8 Expansion (X) Valve Assembly

BACK TO INDEX

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pressure holding the valve closed. The power diaphragm is partially filled with charcoal granules and charged with a specific amount of R-13B1 refrigerant. As the refrigerant returning from the evaporator passes across the X-Valve diaphragm cover and around the sides of the valve above the "O" ring, the temperature of the refrigerant is conducted to the valve. Slight changes in temperature will change the pressure of the R-13B1 gas on top of the diaphragm. Expansion of the diaphragm moves the operating pin and the valve seat to open the X-Valve. Evaporator outlet pressure applied to the bottom of the diaphragm through the equalizer port, opposes the pressure of the diaphragm. Two additional but much smaller forces also act to offset the diaphragm. These are, as previously stated, head pressure and the pressure exerted by the spring in the bottom of the X-Valve. As the pressures balance out, the valve seat is opened enough to provide a constant evaporator temperature. If the evaporator core runs low on liquid refrigerant, the refrigerant vapor will be too warm by the time it reaches the X-Valve on its way to the STV valve. This will increase the R-13B1 gas pressure against the top of the diaphragm. As previously stated, acting through the operating pin, this opens the expansion valve to admit more liquid refrigerant to the evaporator core. Conversely if the evaporator core has too much liquid, the refrigerant passing over the X-Valve will be too cold thus relaxing some of the pressure on the diaphragm allowing it to move toward its closed position thus reducing the flow of liquid refrigerant.

The X-Valve is factory adjusted and cannot be reset or repaired in the field. When it is determined that the valve is malfunctioning, the entire capsule must be replaced.

Equalizer Functions of EEVIR

The equalizer port is used to speed up the opening of the expansion valve under certain conditions. If the STV is throttling toward the closed position to slow down cooling, the upper end of the evaporator core would in time become warm, and this heat would eventually open the expansion valve, due to the pressure of the R-13B1 gas in the power diaphragm. However, at higher car speeds, this length of time could be too great to provide an even outlet temperature because of the time it takes to cool the evaporator core after the expansion valve has opened. To eliminate this fluctuation of temperature and smooth out the cooling to a more constant temperature the equalizer feature was added to help the X-Valve power diaphragm move the valve to the open position without waiting for the X-Valve to warm up.

As the pressure *drops* in the equalizer port and under the diaphragm, the expansion valve would operate the same as if the X-Valve were being heated and exerting *increased* pressure on top of the diaphragm. The expansion valve, therefore, would open and allow refrigerant to flow into the evaporator core because of the *reduced* pressure under the diaphragm rather than due to a pressure increase on top of the diaphragm.

The equalizer port in the EEVIR is a drilled hole in the X-Valve below the power diaphragm. This area is exposed to evaporator pressure by ELIMINATING THE TOP "O" RING used in previous VIR Assemblies. This allows evaporator pressure to enter the equalizer port and eliminates the need for a drilled passage between the STV and X-Valve cavities found in previous assemblies.

Pilot Operated Absolute Suction Throttling Valve

The STV suction throttling valve capsule, Fig. 1-9, is located in the EEVIR unit adjacent to the X-Valve capsule. The function of this valve is to control the flow of refrigerant from the evaporator to maintain a constant evaporator pressure of 29.5 psi (± .5 psi). At this pressure, evaporator coil temperature is maintained at approximately 32°F. (0°C.). Should the evaporator pressure drop much lower it is possible that ice would form in the finned area of the evaporator and block the air flow through the coil.

The capability of the valve to maintain 30 psi is dependent on compressor capacity. At low compressor speed and high evaporator load the pressure may be well above 30 psi and the valve could be wide open. At high compressor speed and low evaporator load the valve closes down and restricts the flow of refrigerant from the evaporator to maintain evaporator pressure to no lower pressure than 29 psi. At this condition, it is

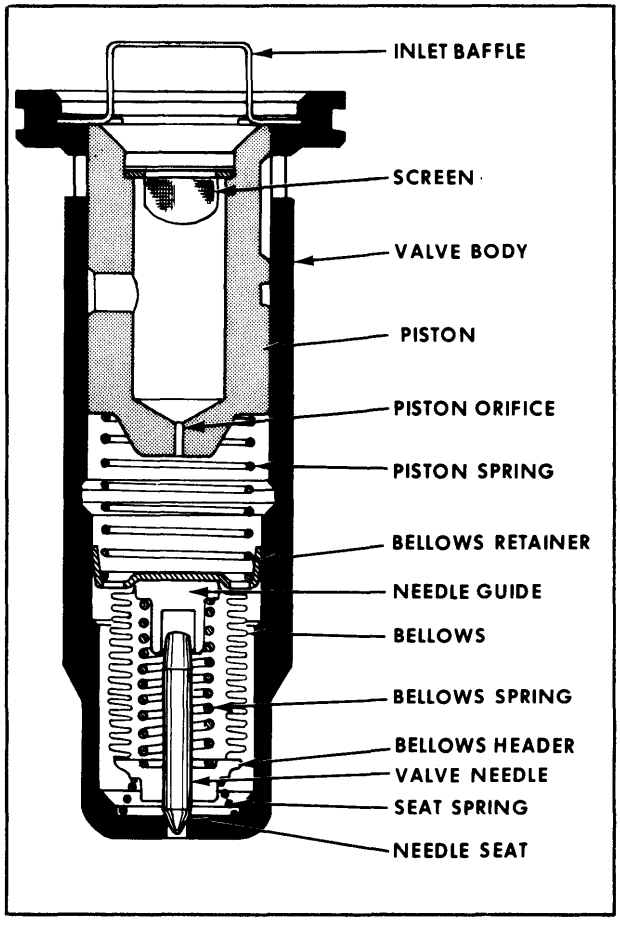


Fig. 1-9 POA Suction Throttling Valve (STV) Capsule

BACK TO INDEX

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normal for refrigerant to flow through the oil bleed line to avoid starving the compressor.

The STV valve capsule consists of the following parts: valve body, valve piston, valve piston spring, bellows retainer, bellows and valve needle assembly and valve needle seat spring. The STV valve capsule is sealed into its cavity in the VIR unit by means of an "O" ring at the top of the valve.

The exterior portion of the STV valve capsule below the "O" ring is subjected to compressor suction pressure. The portions of the STV valve capsule above the "O" ring and the inlet end of the valve piston are subjected to evaporator pressure.

The bellows and valve needle assembly acts as a pilot valve and is evacuated to a near perfect vacuum. It is affected by refrigerant pressure external to the bellows and reacts to pressure as a spring acts to force. That is, when pressure around the bellows increases, the bellows will compress and when pressure decreases the bellows will expand. A spring, needle guide and a portion of the valve needle are contained within the bellows. The seat spring is located between the bellows assembly and the valve seat of the STV valve body and holds the bellows assembly in contact with the bellows retainer. As pressure around the bellows increases, the pilot needle moves away from the needle seat to permit the refrigerant in the bellows chamber to flow out through the orifice to reduce the pressure. As pressure around the bellows decreases, the pilot needle moves toward the seat to decrease refrigerant flow. In this manner the bellows and valve needle assembly regulate the pressure in the area below the valve piston.

The valve piston has a .020"-.022" diameter hole in the spring end of the piston that permits refrigerant to pass to the piston spring and bellows cavity of the valve body. Two holes in the bellows retainer permit the refrigerant to pass from the piston spring area into the area surrounding the bellows. The bellows retainer remains stationary at the "valve set" position determined during the assembly process.

(NOTE: The pressure in the valve piston spring and bellows cavity is the same and will be referred to as "Bellows Cavity Pressure".)

When the Air Conditioning System is in operation, evaporator pressure is applied to the inlet end of the valve piston. Refrigerant passes through the piston screen and drilled hole in the piston to the bellows cavity. As evaporator pressure becomes higher, the force of the valve piston spring and the bellows cavity pressure will be overcome and the piston will move to open the main valve port for refrigerant flow from the evaporator back to the compressor. The piston movement to open the valve port occurs because the combined force of the piston spring, plus the pressure in the bellows cavity against the piston, is less than the force against the piston due to evaporator pressure. With the valve open and metering refrigerant flow back to the compressor, evaporator pressure will decrease toward 30 psi. As the combined force of the piston spring plus the pressure in the bellows cavity against the piston overcomes the force against the piston due to evaporator pressure, the valve will move to close the valve port and decrease the flow of refrigerant back to the compressor.

When evaporator pressure is greater than the pressure in the bellows cavity, refrigerant flows through the piston orifice to maintain control pressure in the bellows cavity. This pressure affects valve piston movement and bellows movement of the valve needle seat orifice and maintain a modulating control pressure in the bellows cavity.

When the pressure surrounding the evacuated bellows increases, the bellows will compress and lift the needle from the seat. The refrigerant will then flow from the bellows cavity through the needle seat orifice to the suction line. When the flow of refrigerant through the needle seat orifice exceeds the flow of refrigerant into the bellows cavity through the piston orifice, the bellows cavity pressure will decrease and the bellows will expand to move the needle toward the seat.

The balance of forces acting upon the valve piston (evaporator pressure on one side versus bellows cavity pressure and piston spring force on the opposite side of the piston) and the piston controlled flow of refrigerant through the needle seat orifice, tend to hold the valve piston and valve needle in the modulated flow positions, thus maintaining the predetermined bellows cavity pressure to control evaporator pressure.

The STV valve capsule is factory set and is not adjustable or field repairable. When it is determined that the valve is malfunctioning the complete STV valve capsule must be replaced.

Temperature Control System

The temperature control system provides automatic regulation of the car interior temperature regardless of outside temperature changes. The control panel, Fig. 1-10, consists of a temperature dial with a range of 65°F to 85°F (18°C to 29°C) and a single sliding lever to permit the driver to choose various modes of operation. Either the "Economy" or "Auto" settings are recommended for most situations. There are 5 additional settings which provide driver control for unusual conditions. An explanation of the system operation at various lever settings begin on page 1-24.

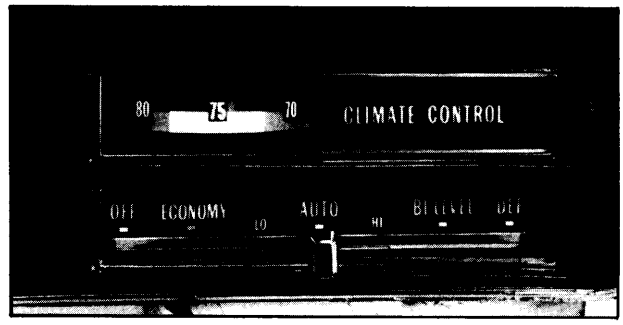


Fig. 1-10 Climate Control Panel Face

BACK TO INDEX

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Control System Components

Following is a complete list of the components which comprise the temperature control system. The location of the part is given together with a brief description of how the part works. System operation and how the various components interact within the system is explained in a subsequent section.

a. Control Panel

The control panel, Fig. 1-10, is located in the instrument panel cluster to the left of the steering column and consists of a plastic bezel and baseplate, an acrylic lens and the functional components described below.

The *temperature dial* is graduated in 5°F increments between 65° and 85° (18°C to 29°C) and is color-coded – red for hot blue for cold and white for moderate temperatures – to facilitate adjustments. The dial actuates and varies the resistance of a wire-wound rheostat mounted directly above it.

The *circuit board electrical switch* is mounted on the underside of the baseplate. Attached to and positioned by the control lever are wiper contacts which ride on the circuit board pads to provide the required electrical circuit connections. How these connections are made is shown in Figs. 1-31 through 1-37. Electrical wires from the switch and from the temperautre dial rheostat terminate at a ten-way connector.

The *in-car turn-on switch* is a thermostatic switch enclosed in a small plastic cylinder located just forward of the wire-retaining clip on the baseplate. It senses car interior temperature and will close and turn the system on if that temperaure is above approximately 75° (24°C), even if engine water is cold and the other turn-on switch, located in the right cylinder head, is cold. This provides immediate cooling in a hot car that has not been run for some time.

The *control vacuum valve*, located at the forward edge of the baseplate, is a nine-port rotary valve which interconnects or vents the vacuum hoses attached to it to perform various vacuum functions required in the system. How the valve performs these functions is shown in Figs. 1-16 through 1-22.

The control lens and the temperature dial are illuminated by a single bulb on the right side of the control.

b. Sensors

Two sensors are used, one sensing outside air temperature and the other the car interior temperature. Both are disc-type thermistors approximately .30" in diameter and .060" thick. (A thermistor is a special resistor with a value that changes markedly with temperature change -- it also differs from an ordinary resistor in that its resistance decreases as it gets hotter). The changes in resistance of these units forms the basic input to the control system.

The *in-car sensor* is located behind the slots on the instrument panel top cover.

The *ambient sensor* is mounted on a flat phenolic board that is attached to the plenum surface of the evaporator. Also mounted on this board is the *compressor ambient switch*; this switch is a bi-metal disc-type, snap-action thermostatic switch that disconnects the compressor below approximatley 37°F (3°C) ambient temperature. Both the sensor and the switch protrude into and sense the temperature of the air stream entering the evaporator core. Fig. 1-39 shows sensor characteristics.

c. Aspirator

To provide accurate sensing of the car interior temperature, a small amount of air is drawn into the in-car sensor housing and passed over the thermistor. See Fig. 1-11. This air movement is accomplished by the use of an aspirator mounted on top of the heater assembly and a rubber hose that connects the in-car sensor housing to the aspirator. The aspirator is a tube-within-a-tube arrangement; air from the heater case is discharged out the main, outer tube -- this air stream causes a suction at the end of the inner tube so that air flows out it also. The aspirator is equipped with a shield to prevent its outlet end from being blocked.

d. Programmer

The programmer designated MKII, contains the bulk of the temperature control components, and is located in the passenger compartment on the right-hand end of the heater case. It may be identified by the white

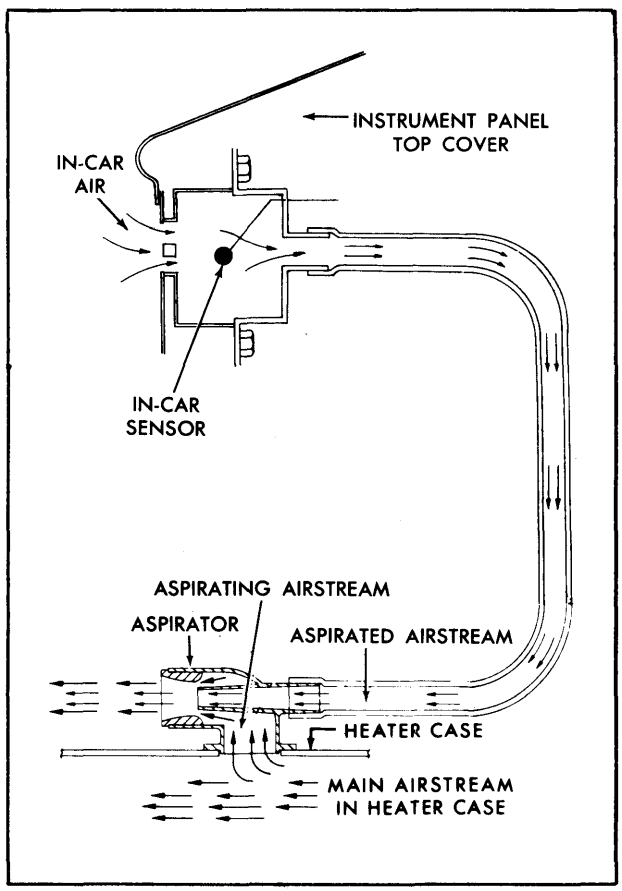


Fig. 1-11 In-Car Sensor and Aspirator

BACK TO INDEX

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electrical connector. It consists of a zinc die-cast chassis, a removable plastic cover and the functional components described below. See Fig. 1-12.

The *amplifier,* mounted to the programmer chassis, is a three-stage D-C amplifier that accepts a weak electrical signal from the sensors and the temperature dial and provides a strong output signal proportional to input. The amplifier should be serviced only as an assembly. No attempt should be made to repair an amplifier except by an experienced electronics technician with the proper service aids for calibration.

The *transducer,* is mounted directly to the amplifier board and is essentially a throttling device with the vacuum level set by balancing an air force against a ball with a magnetic attraction between the armature and pole piece. Output current from the amplifier flows through the solenoid coil to control the vacuum level of the transducer. This component, in effect, transforms the electrical signal from the amplifier to a vacuum signal which is fed to the vacuum motor.

The *vacuum checking relay* provides two separate vacuum checking functions. See Fig. 1-13. In the upper part of the relay is a conventional rubber check valve which is opened by engine vacuum applied at port 5, allowing port 3, which supplies vacuum to the rotary vacuum valve on the programmer and the control head, to be evacuated. If engine vacuum drops because of acceleration or steep grades, the check valve closes, maintaining the vacuum level at port 3.

In the lower part of the relay is a spring-loaded diaphragm which blocks or passes regulated vacuum from the transducer which is connected at port 2 to the vacuum motor which is connected to port 1. When engine vacuum at port 5 is high, the diaphragm is pulled upward allowing regulated vacuum to pass to the vacuum motor. When engine vacuum drops, the daphragm moves downward blocking passage and maintaining vacuum in the vacuum motor.

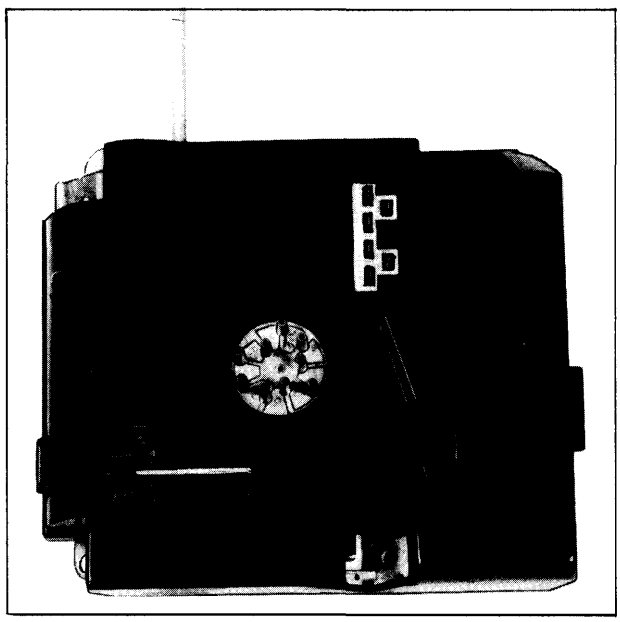


Fig. 1-12 MK II Automatic Temperature Control Programmer

The *vacuum motor,* produces all mechanical motion within the programmer. It positions the vacuum motor mechanism which actuates the rotary shaft which drives the air-mix door link. This same mechanism moves the blower circuit board wiper, the vacuum valve operating arm and the feedback potentiometer. The vacuum motor mechanism is spring-loaded by a spring at its left-hand end so that with no vacuum it is fully extended out of the vacuum motor. This is the "Max A/C" position. When vacuum is applied to the vacuum motor, the mechanism is pulled into the vacuum motor -- approximately 8" of vacuum is required to pull the mechanism all the way to the "Max Heat" position. In order to prevent the loss of position during stop/restart operations, it is necessary to add a restriction between the vacuum checking relay and the transducer. This a sintered plug-in hose type.

The *blower circuit board switch* is located in the center part of the programmer. Spring-loaded contacts move across the board making the required blower circuit connections. The configuration of this switch is similar to that of the circuit board switch on the control head. Three resistors are attached to the underside of the circuit board and protrude through into the programmer adapter. Air from the evaporator is ducted to the adapter to provide cooling for them. The function of the switch is to place these resistors into the blower circuit at the required points in the program to control blower speed. A low blower resistor is also attached to the circuit board. Refer to the electrical circuit diagram contained in Fig. 1-40.

The *vacuum valve*, located in the center of the assembly, is a nine-port rotary valve which makes connections between the various ports or vents them, as required, to move air doors, operate the heater water valve, etc. Refer to vacuum circuit in Fig. 1-22 for additional information.

The *feedback potentiometer* is located just above the vacuum valve. Its function is to snub movement of the vacuum motor so that a small signal from the sensors does not drive the motor all the way, one way or the other. The feedback pot is located, electrically, in the sensor string circuit and operates in opposition to the sensors -- if a sensor drives the vacuum motor toward "Max Heat", for example, when the motor starts to move, it will rotate the potentiometer so that its resistance change tends to offset the resistance change of the sensor. This unit is adjustable – follow Note 15c carefully when adjusting it.

The sequence of events in the control program as the programmer moves from "Max A/C" to "Max Heat" is given below:

1. Possibility of recirculated air is terminated.
2. Heater water valve opens.
3. Blower speed drops from HI to M_3.
4. Air-mix door starts to move, blending in hot air.
5. Blower speed drops to M_2.
6. Blower speed drops to M_1.
7. Mode of air delivery changes from A/C to Bi/Level.
8. Mode of air delivery changes from Bi/Level to heater.

BACK TO INDEX

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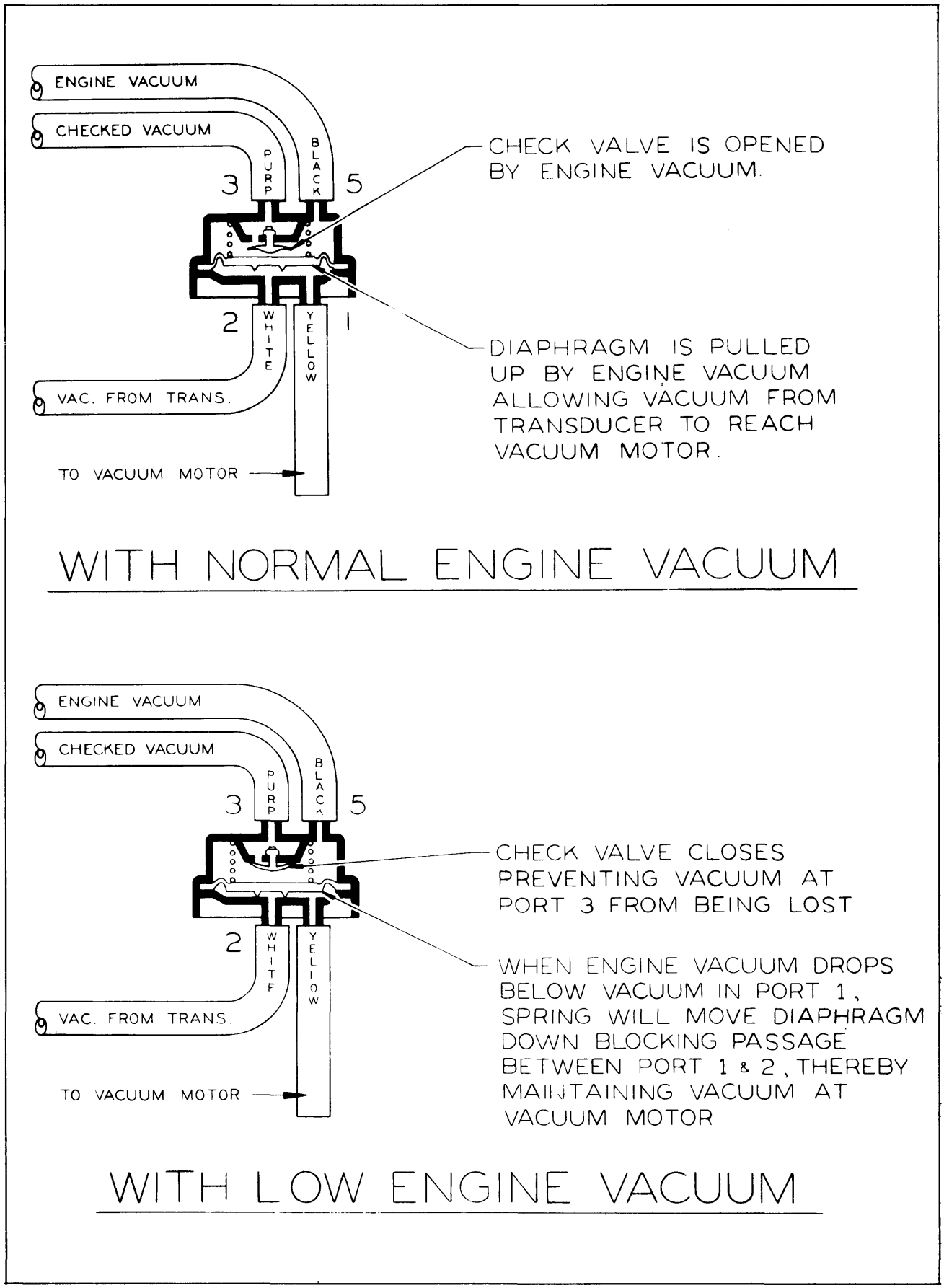


Fig. 1-13 Vacuum Checking Relay Operation

BACK TO INDEX

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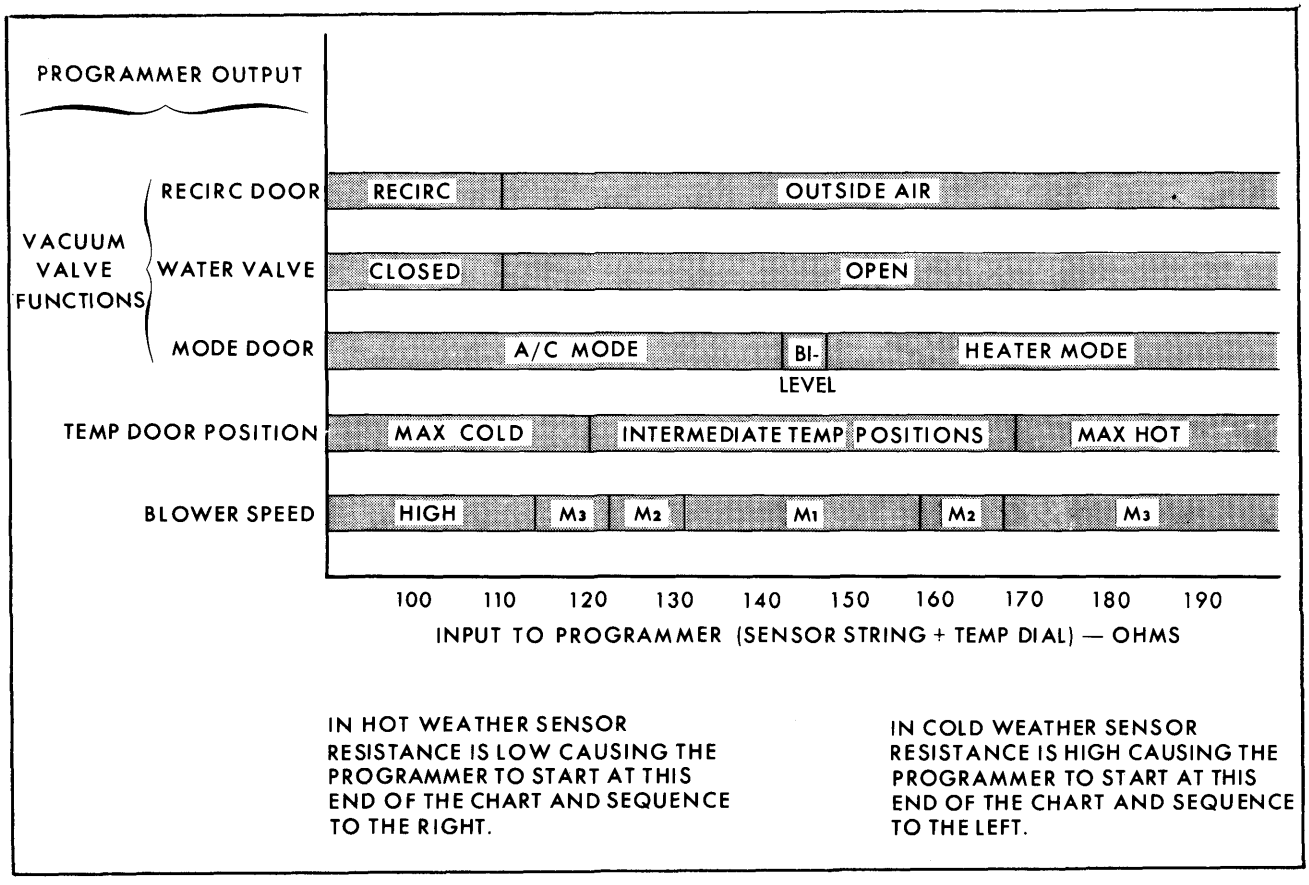


Fig. 1-14 Programmer Input-Output Chart

9. Blower speed increases to M_2.
10. Air-mix door reaches "Max Heat" position.
11. Blower speed increases to M_3.

The sequence of events is reversed as the programmer moves from "Max Heat" to "Max A/C".

e. Air-Mix Door Link

The air-mix door link consists of a spring steel crank arm which slips down over the top of the output shaft of the programmer and a rod riveted to the crank arm. The other end of the rod attaches to the air-mix door crank arm and is retained to it with a clip. The spring steel crankarm is attached to the output shaft with a set screw which is tightened when the link is adjusted. The programmer positions the air-mix door by this link. See Note 15b for adjustment procedure.

f. Blower Relay

A single-pole, single throw relay is used to supply power to the blower. It is located on the evaporator case in the engine compartment. The Relay supplies power in all except the "Off", and "Lo" positions of the control lever.

g. Heater Turn-On Switch

This switch is a bi-metal, snap-action switch located on the front of the right cylinder head. It senses engine coolant temperature; it is closed above approximately 120°F (49°C) and is open below that temperature.

h. Heater Water Valve

This valve is located on the evaporator assembly. Its function is to pass or block flow of water to the heater. It is normally open but is closed by vacuum from the programmer vacuum valve when the programmer is positioned at "Max A/C".

Control System Operation

The automatic temperature control system is made up of three major sections which perform the following operations:

A. Temperature Control
B. Blower Control
C. Auxiliary Electrical and Vacuum Functions

The above sections will be described separately and in detail to aid system understanding and service diagnosis. System response at various lever settings is shown in Figs. 1-15 through 1-37.

a. Temperature Control Circuit

This circuit is comprised of the following parts, described in the preceding section and shown in Fig. 1-43.

BACK TO INDEX

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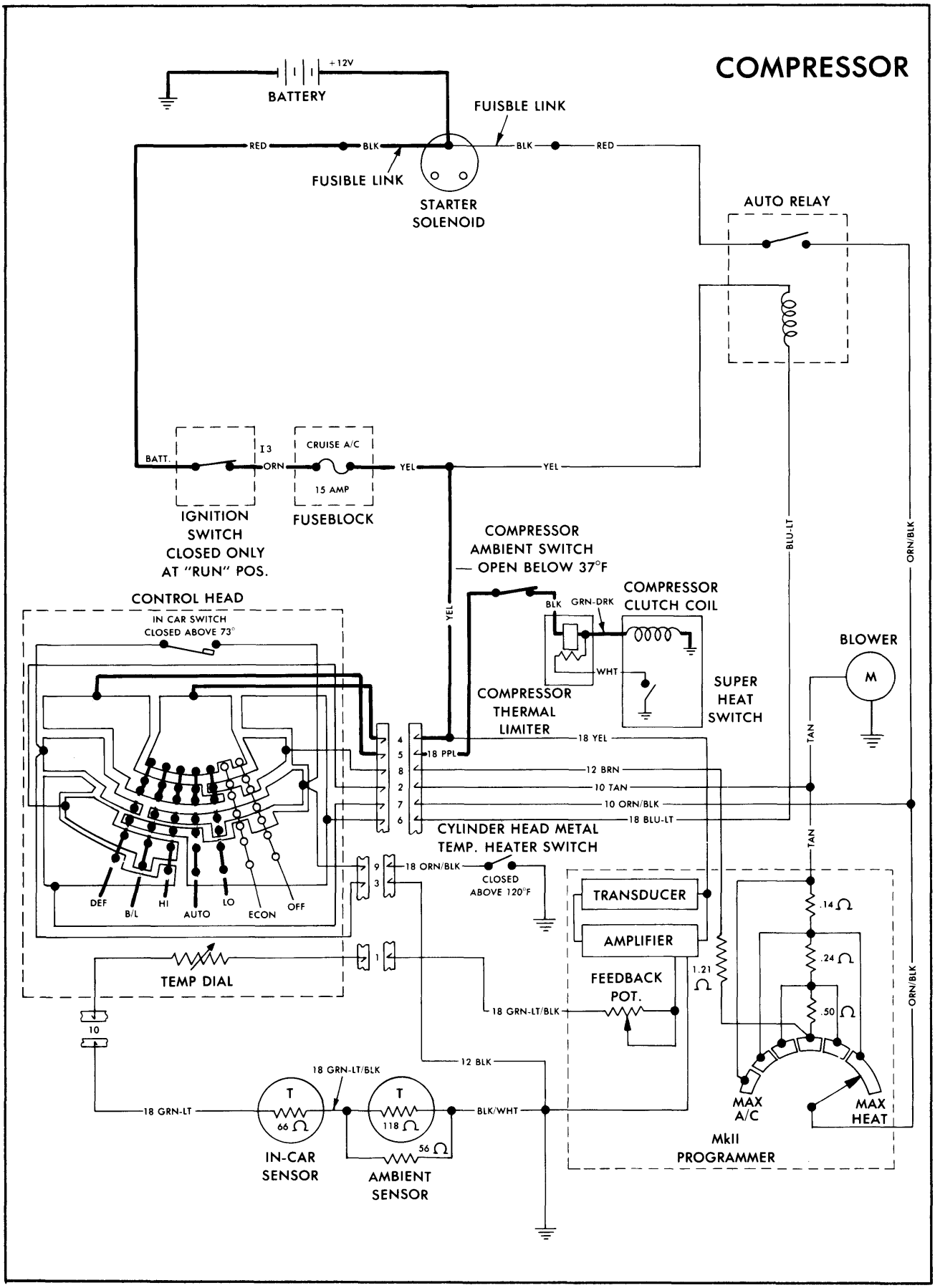


Fig. 1-15 Compressor Electrical Circuit

BACK TO INDEX

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- Ambient Sensor
- In-Car Sensor
- Temp Dial

} Input to Programmer

- Feedback Pot
- Amplifier
- Transducer
- Vacuum Relay
- Vacuum Motor

} Programmer

The resistance of the two sensors varies with their temperature. Their resistance, plus that of the temperature dial, form the input to the programmer. This weak electrical signal, which varies with the temperature of the sensor or with temperature dial movements, is amplified by the amplifier to produce a relatively strong current flow through the transducer that varies in accord with input signal changes. The transducer converts this electrical signal to a proportional vacuum signal which is routed through the vacuum relay to the vacuum motor. The vacuum motor performs the following five output functions:

1. Positions the air-mix door
2. Positions the wiper on the blower circuit board switch
3. Controls mode door operation } Through Vacuum Valve
4. Controls heater water valve
5. Controls recirc and outside air doors

Input-output characteristics of the programmer are shown in Fig. 1-14. Input is resistance in ohms; output consists of the five functions listed above. Several examples are listed below to provide further understanding.

1. Assume the car is stabilized on a sunny 80° (27°C) day with the in-car sensor being maintained at 75° (24°C) with a 75° temp dial setting. The resistance of the ambient sensor at 80° is 32 ohms, the in-car sensor resistance at 75° is 68 ohms, and the temp dial resistance at the 75° setting is 36 ohms. These three resistances total 136 ohms. Referring to Fig. 1-14, this resistance will position the programmer to produce M_1 blower speed, an intermediate discharge air temperature (approximately 60°), A/C mode, an open heater water valve and outside air.

2. If the ambient temperature were to increase to 90° (32°C), the ambient sensor resistance would *decrease* to 26 ohms. This change in resistance would cause amplifier output current to increase which would cause the transducer output vacuum to the vacuum motor to decrease so that the new point of operation would be at the 130 ohm point in Fig. 1-14, producing M_2 blower speed and colder discharge air. The system would still be in A/C mode, with the water valve open, utilizing outside air. In this way, the in-car temperature is maintained at 75° despite the change in ambient temperature.

3. If heat load on the car were to be decreased, by driving under cloud cover, for example, the in-car sensor temperature would tend to decrease. This would cause its resistance to *increase* so that the total resistance to the programmer would increase. This would cause the programmer to move back to the right on the chart to a warmer position.

Note in the foregoing examples that an increase in amplifier output current cause a *decrease* in transducer output vacuum. Understanding this and similar relationships is important in problem diagnosis - for that reason they are listed below.

6 *Hot* sensors result in *low* sensor string resistance which results in *high* amplifier output current which results in *low* transducer output vacuum which positions the vacuum motor in the *cool* or cold area of operation.

- Conversely, *cold* sensors operate at *high* resistance which results in *low* amplifier output which causes a *high* transducer vacuum which positions the vacuum motor in the *warm* or hot area of operation.

It is worth noting that an open sensor (disconnected, etc.) would represent a high resistance (as though the sensor were very cold) which would drive the programmer to maximum heat, while a shorted sensor would produce low resistance and drive the system to "Max A/C".

b. Blower Control Circuit

Three modes of blower speed control are available to the driver. During A/C operation and two during heater operation in addition to the constant low blower speed.

1. Fixed low blower speed.
2. Four blower speeds automatically controlled by the programmer, ranging from M_1, which is slightly higher than the fixed low speed, through M_2 and M_3 (plus high in A/C mode).
3. Fixed high blower speed (approximately the smae as the high in the automatic range). Or M_3 in heater operation.

Blower turn-on occurs in the following ways:

1. Delayed turn-on in cold weather until warm water is available from the engine in all positions except "Off" and "Lo".
2. Immediate turn-on in warm weather when the car interior is warm, regardless of engine water temperature.
3. Immediate turn-on regardless of temperatures, by owner override to the "Vent" or "Def" lever settings.

c. Auxiliary Electrical and Vacuum Functions

The *Compressor Clutch Circuit* is shown in Fig. 1-15. When the ignition switch is closed, current flows through two pads on the control head which are inter-connected at all lever settings except "Off" and "Economy" and through the compressor ambient switch, which is closed above approximately 32° (0°C), to the compressor.

Auxiliary vacuum circuits are those which provide vacuum to operate the various air doors and the heater water valve. They do not include vacuum circuitry connected with the transducer and vacuum motor which functions independently and was explained in a previous section.

BACK TO INDEX

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MODE DOOR OPERATIONS

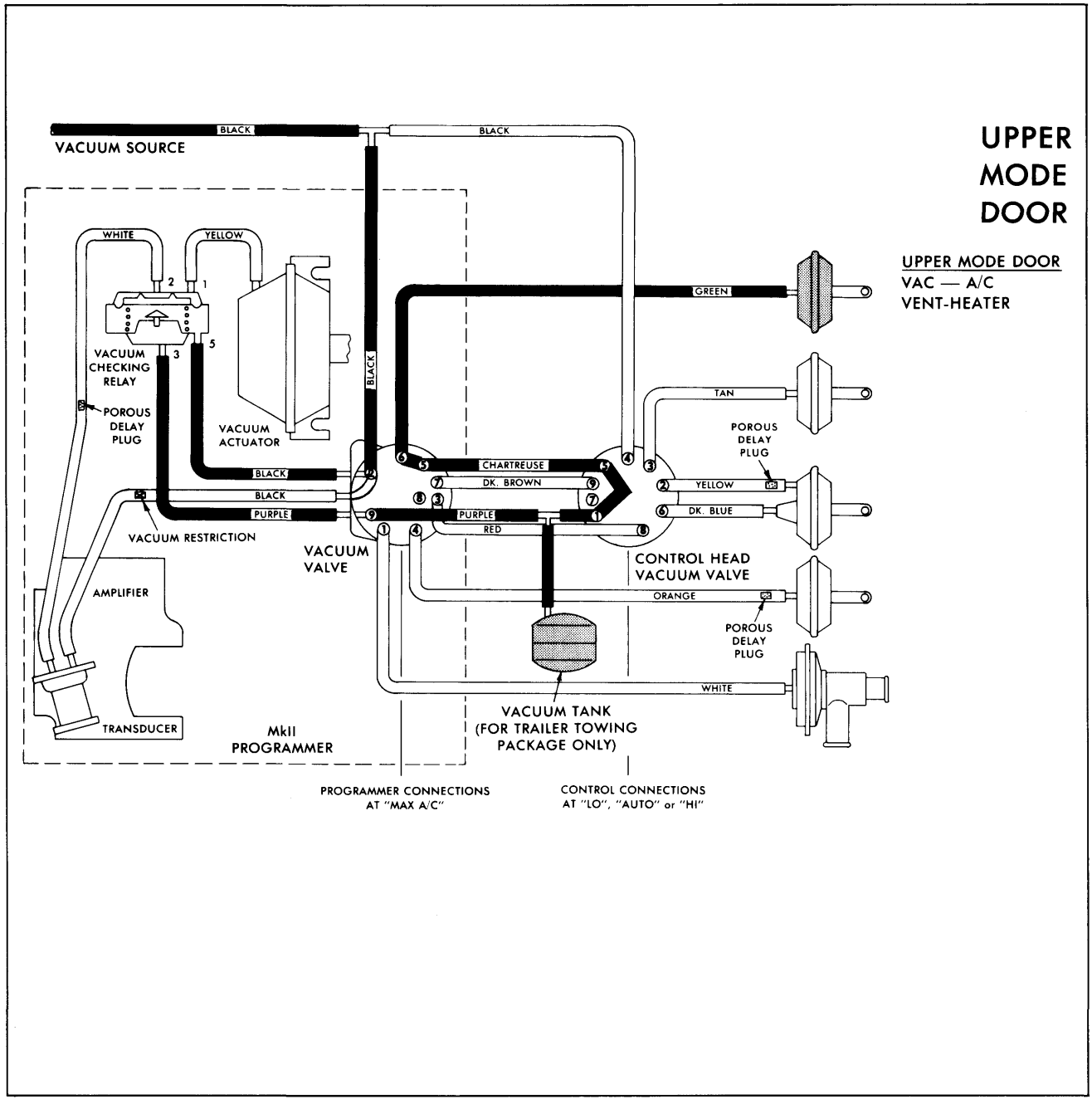


Fig. 1-16 Upper Mode Door Vacuum Circuit

Upper Mode Door Vacuum Circuit (Fig. 1-16)

The upper mode door actuator is connected by a green hose to port 6 on the programmer valve. This port is vented in the heater portion of programmer travel so that the actuator is vented which places the mode door in the heater position. When the programmer is positioned toward the "Max A/C" position, port 6 is connected to port 5, which is connected by the chartreuse hose to port 5 on the control head vacuum valve. This port is vented at "Off", "Bi-Level" and "Def" so that the door must remain in the heater position at those settings even though the programmer is positioned to produce A/C mode. At "Lo", "Auto" and "Hi", however, port 5 is connected to port 1, as is shown above. This port is connected by the purple hose to port 9, back on the programmer valve. Port 9 has checked vacuum at all times, which it receives from the check valve portion of the vacuum checking relay. The vacuum checking relay receives its vacuum from port 2 which has full vacuum at all times.

BACK TO INDEX

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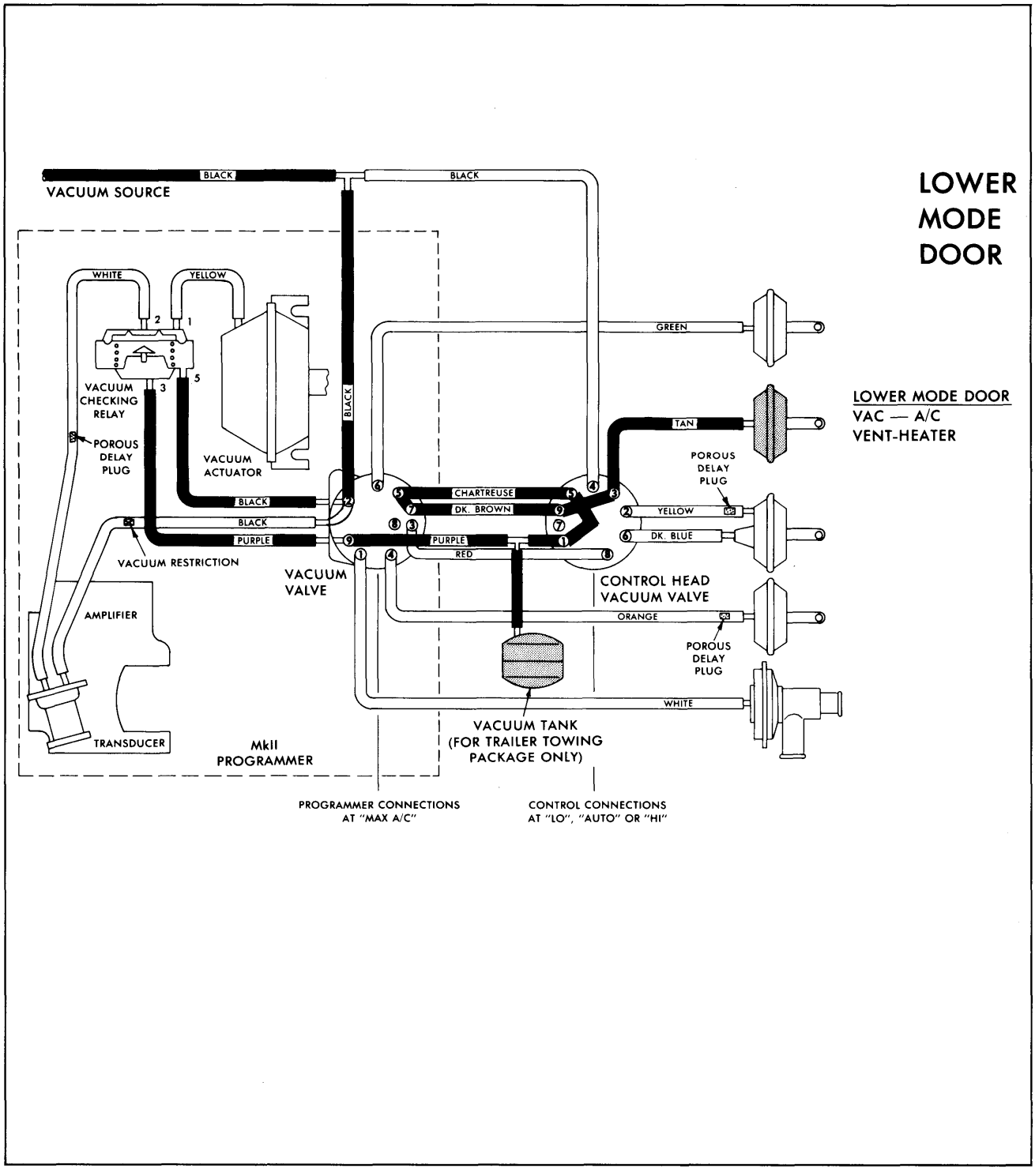


Fig. 1-17 Lower Mode Door Vacuum Circuit

Lower Mode Door Vacuum Circuit (Fig. 1-17)

The lower mode door actuator is connected by a tan hose to port 3 on the control head. Port connections in the control valve at "Lo", "Auto" and "Hi" are as shown above. At the programmer, port 5 is connected to port 7 in the A/C portion of programmer travel, as shown. Under these conditions, checked vacuum is fed to the actuator which positions the lower mode door in the A/C position. At "Off" and "Def", port 3 on the control head is vented forcing the door to heater mode. At "Bi-Level", port 3 is connected to port 1 on the control head, forcing the mode door to the A/C position regardless of the position of the programmer.

BACK TO INDEX

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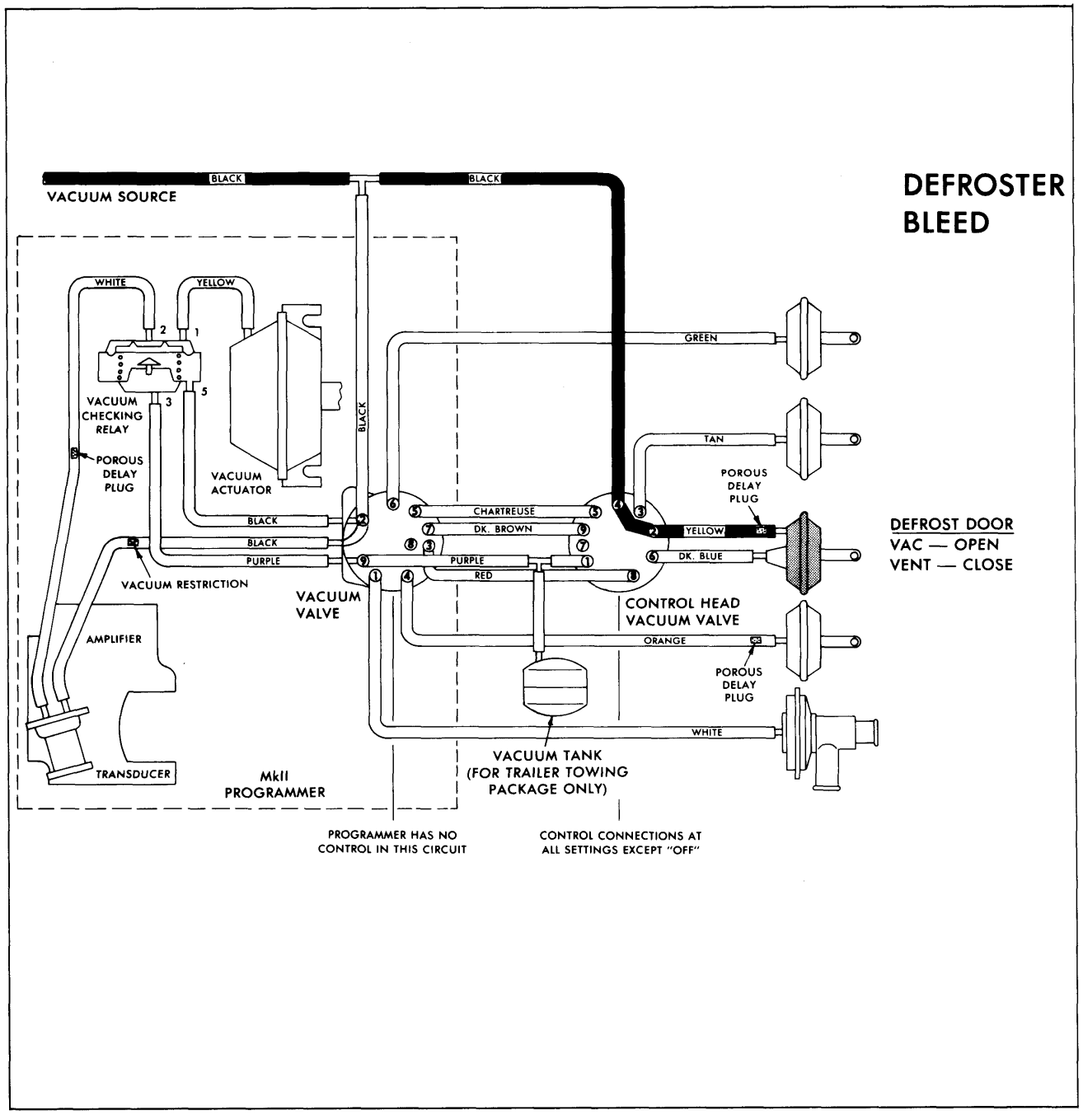


Fig. 1-18 Defroster Bleed Vacuum Circuit

Defroster Bleed Vacuum Circuit (Fig. 1-18)

To provide a small "bleed" of air to the defroster outlet in heater mode, the defroster door is open approximately .75 inch. This is accomplished by applying vacuum to the outer nipple of the two-stage defroster actuator. The outer port is connected by the yellow hose to port 2 on the control head. This port is connected to port 4 at all lever settings except "Off" in which case port 2 is vented. This provides the possibility of defroster bleed at all settings except "Off". The programmer exerts an indirect influence in this function; if it, in conjunction with the control head valve, provides vacuum to put the mode doors in the A/C positions, these doors intercept all air headed toward the defroster door and there is no defroster bleed air even though the defroster door is cracked open. Note that port 4, which feeds vacuum to the defroster bleed nipple, is connected to full engine vacuum, not checked vacuum. This is done deliberately to permit the vacuum to escape when the car is stopped so that the defroster door will seal. A restrictor is located in the yellow hose to provide a delay of approximately 45 seconds in the operation of the door. This prevents fogging of the windshield that can sometimes occur when the car is restarted.

BACK TO INDEX

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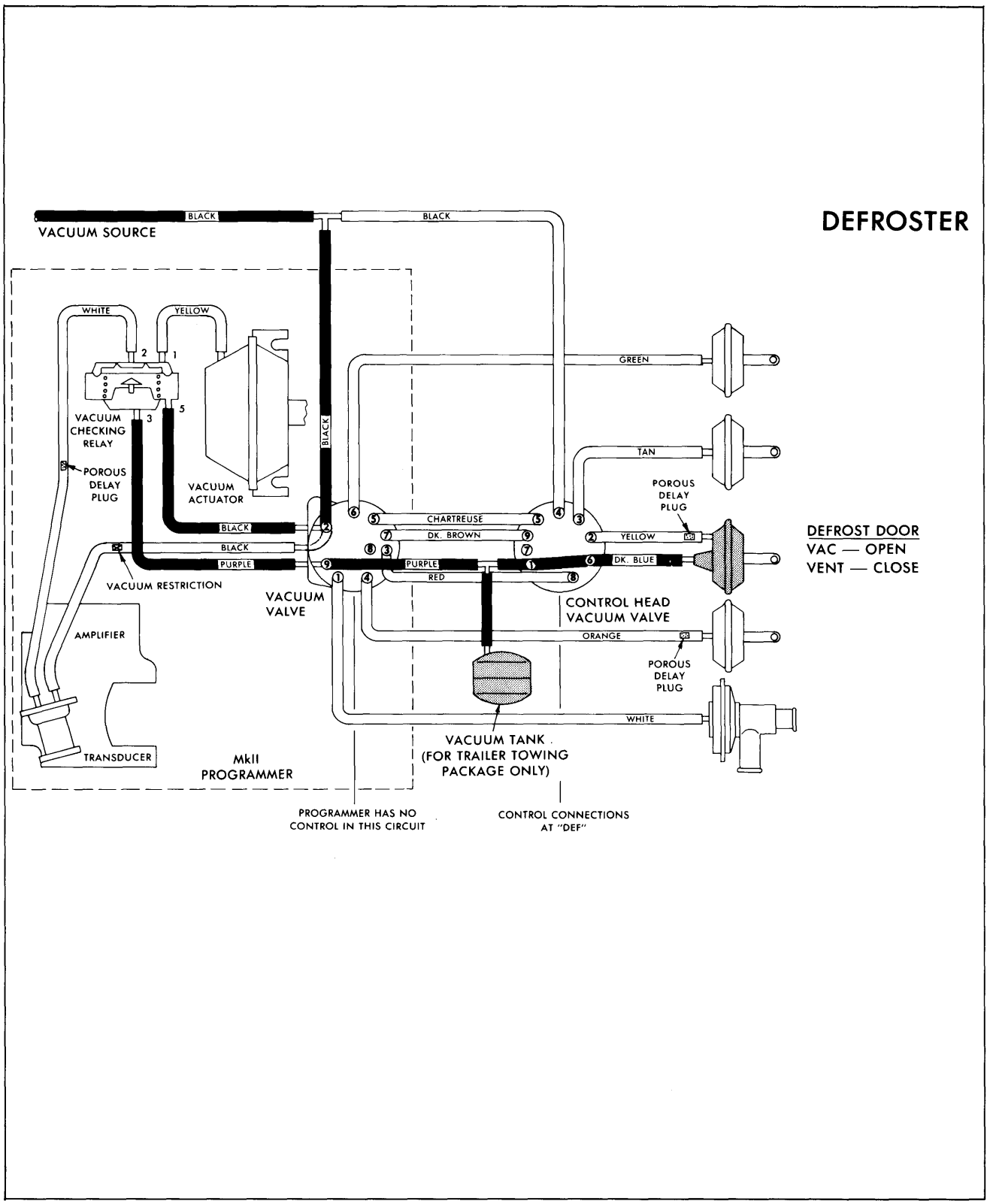


Fig. 1-19 Defroster Vacuum Circuit

Defroster Vacuum Circuit (Fig. 1-19)

The defroster door is moved full open when vacuum is applied to the center nipple of the actuator. This nipple is connected by the dark blue hose to port 6 on the control head. This port is vented at all settings except "Def" where it is connected to port 1, as shown. The programmer has no control in this circuit.

BACK TO INDEX

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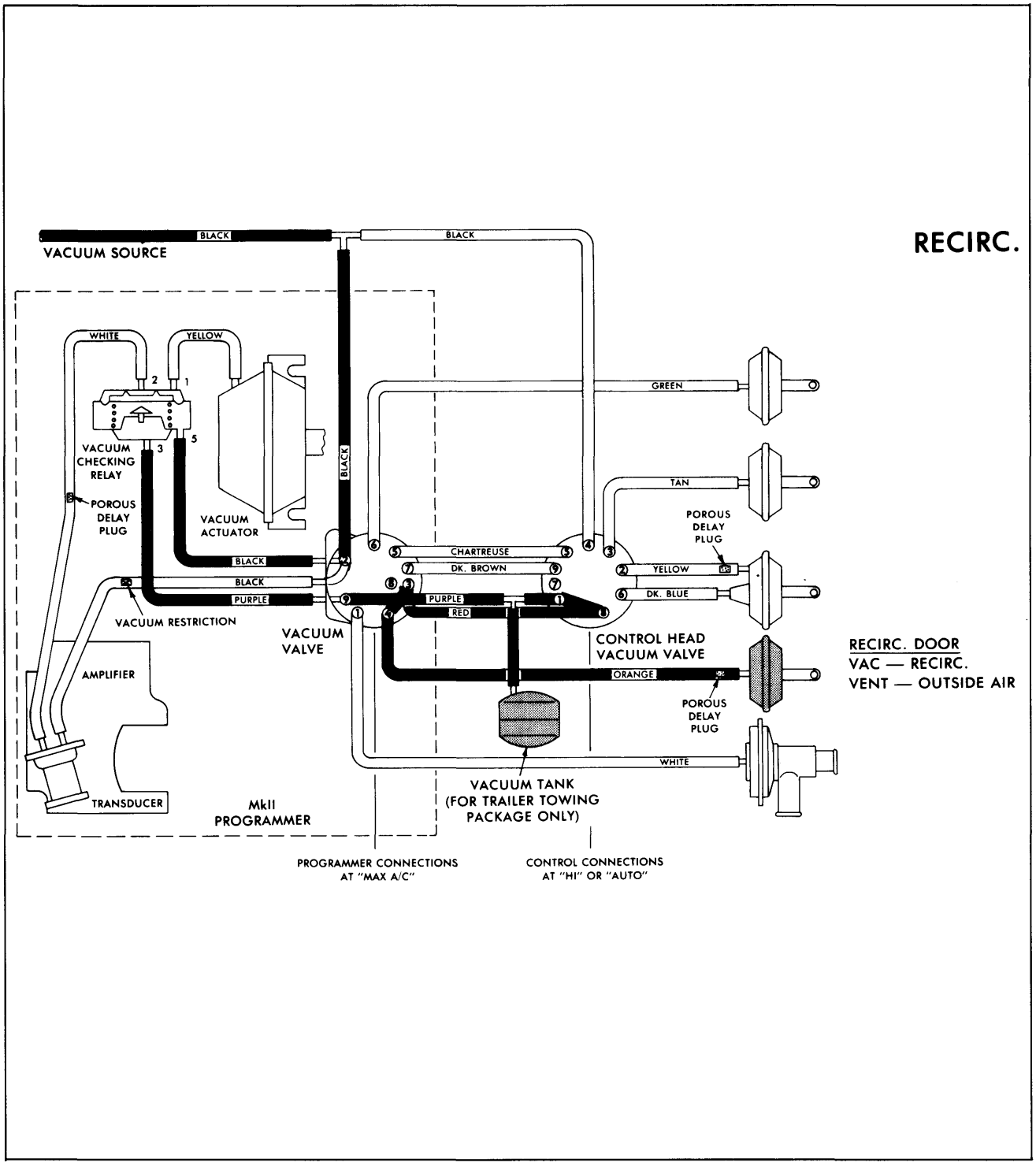


Fig. 1-20 Recirc Air Vacuum Circuit

Recirc Air Vacuum Circuit (Fig. 1-20)

The recirc air actuator is connected by the orange hose to port 4 on the programmer. This port is vented at all programmer positions except "Max A/C", resulting in outside air. At "Max A/C", port 4 is connected to port 3 which is connected by the red hose to port 8 on the control head. Port 8 is connected to checked vacuum at port 1 at the "Auto", "Hi", "Bi-Level" and "Def" settings. Thus, if the programmer is at "Max A/C" and the control is at "Auto", "Hi", "Bi-Level" or "Def" recirc air operation will be obtained.

BACK TO INDEX

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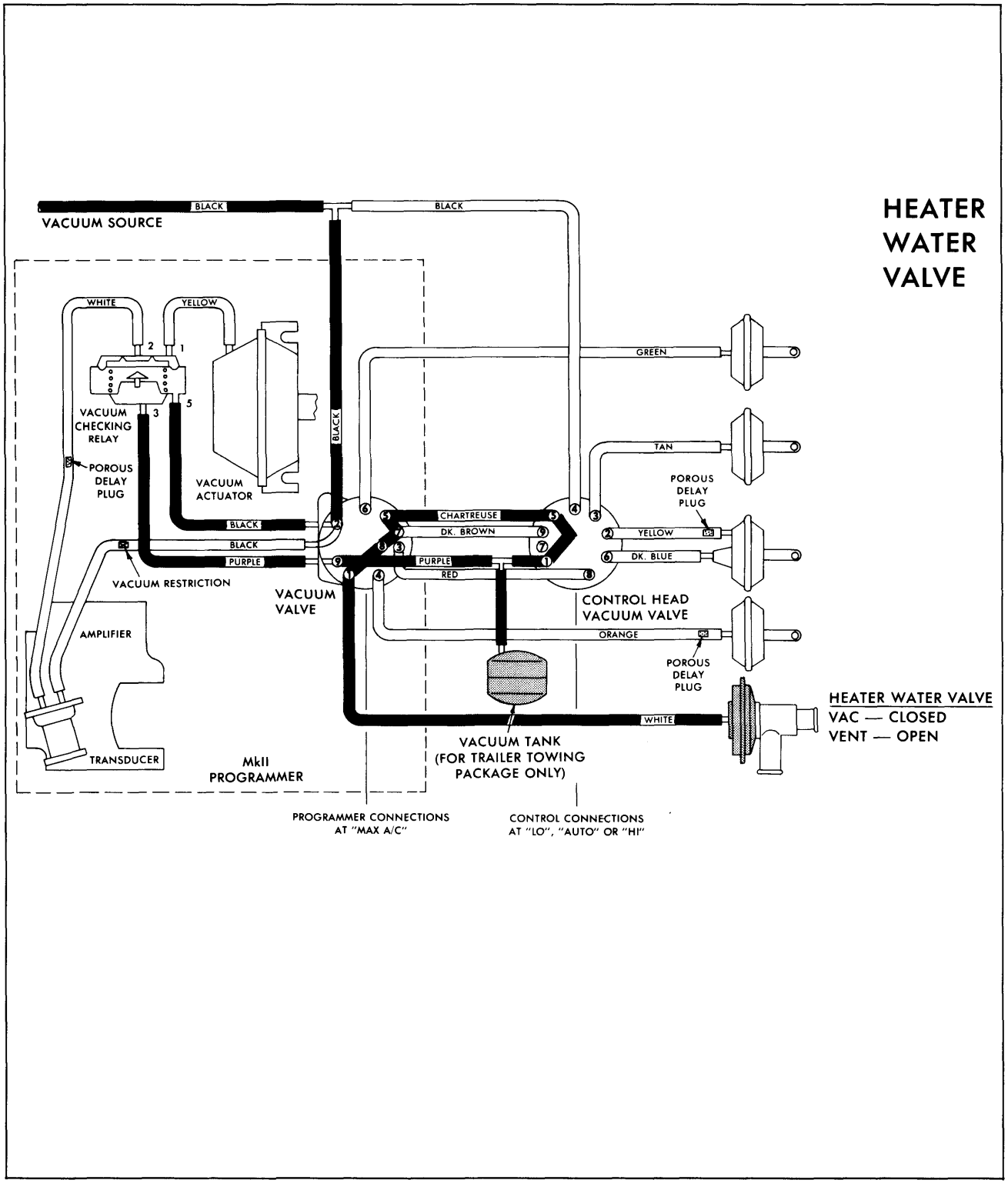


Fig. 1-21 Heater Water Valve Vacuum Circuit

Heater Water Valve Vacuum Circuit (Fig. 1-21)

The water valve is connected to port 1 of the programmer which is vented, opening the valve, at all programmer positions except at the "Max A/C" end of travel. There it is connected, as shown, to port 5 which is connected by the chartreuse hose to port 5 on the control head. At "Economy", "Lo", "Auto" and "Hi", port 5 is connected to checked vacuum at port 1, closing the valve.

BACK TO INDEX

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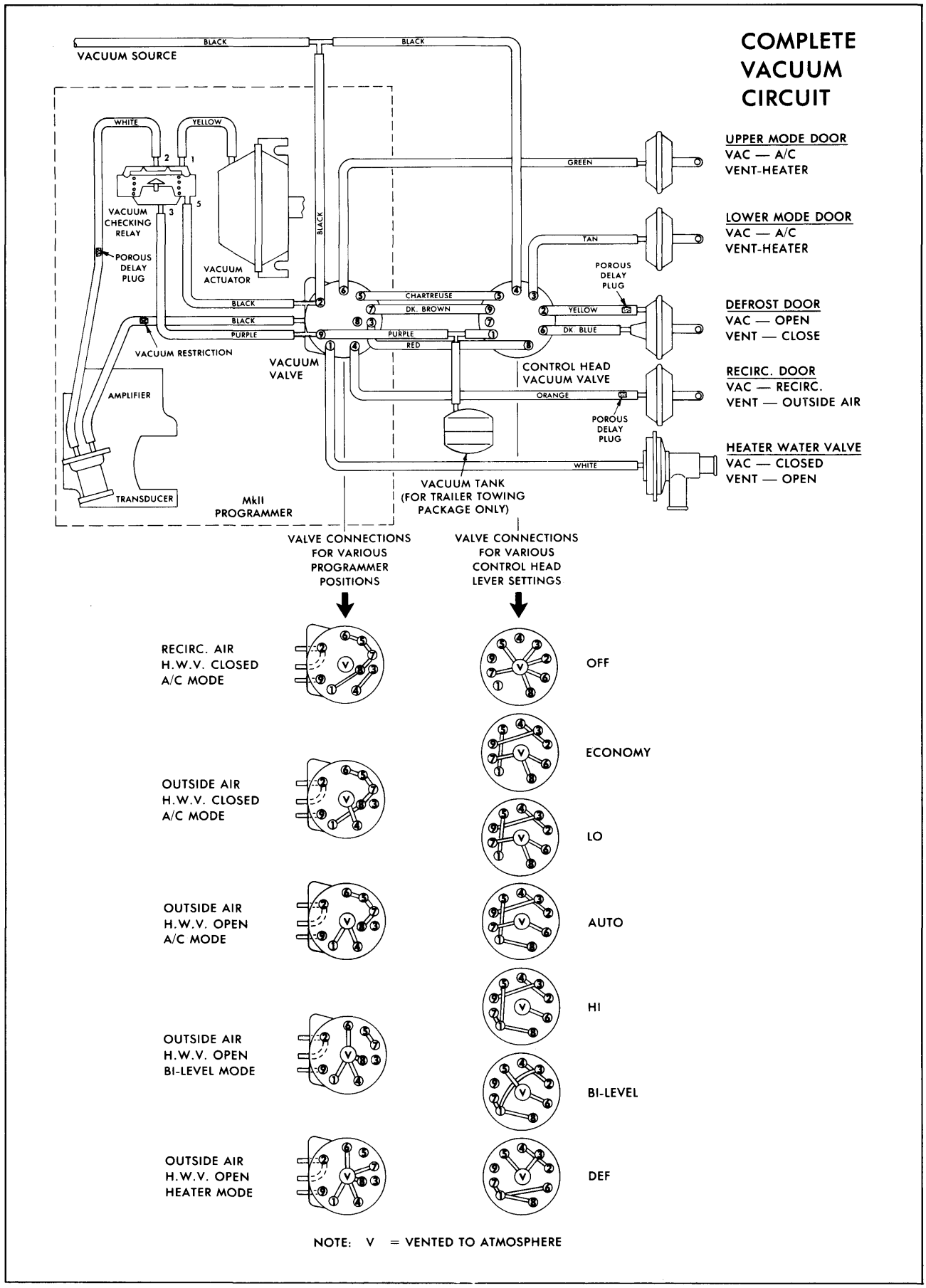


Fig. 1-22 Complete Vacuum Circuit

BACK TO INDEX

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Complete Vacuum Circuit Diagram

A complete vacuum circuit diagram is shown in Fig. 1-22. Included are "clocks" which show the internal connections of the programmer and control head vacuum valves at various positions and settings.

Complete Electrical Circuit Diagrams

Fig. 1-40 shows a complete circuit diagram in a form to permit easy tracing of circuits. Fig. 1-49 is a wiring circuit diagram that shows actual wiring arrangements, such as connectors, bulkhead connectors, location of splices, etc. The two circuits are in agreement in everything except the form in which they are presented.

AIR FLOW AT VARIOUS LEVER SETTINGS

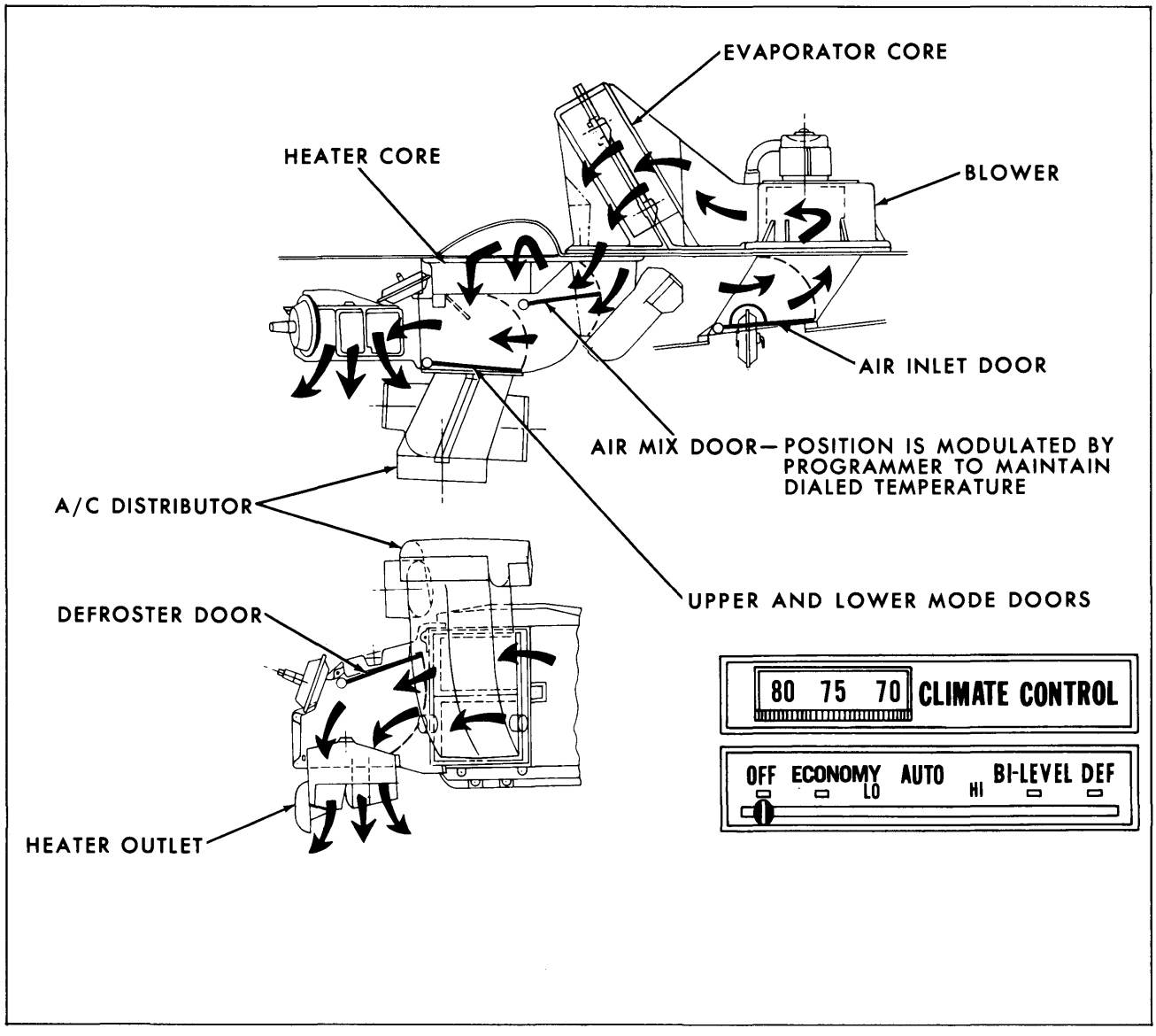


Fig. 1-23 Air Flow at "OFF"

Off

Outside air is circulated at a fixed low blower speed through the evaporator and heater assembly and discharged into the passenger compartment from the heater outlet when the ignition switch is in the "Run" position if turn on requirements are met. The temperature of the air is modulated to maintain the temperature on the dial; the ability of the system to maintain this temperature in warm weather is restricted, however, since the compressor is disengaged at this setting.

BACK TO INDEX

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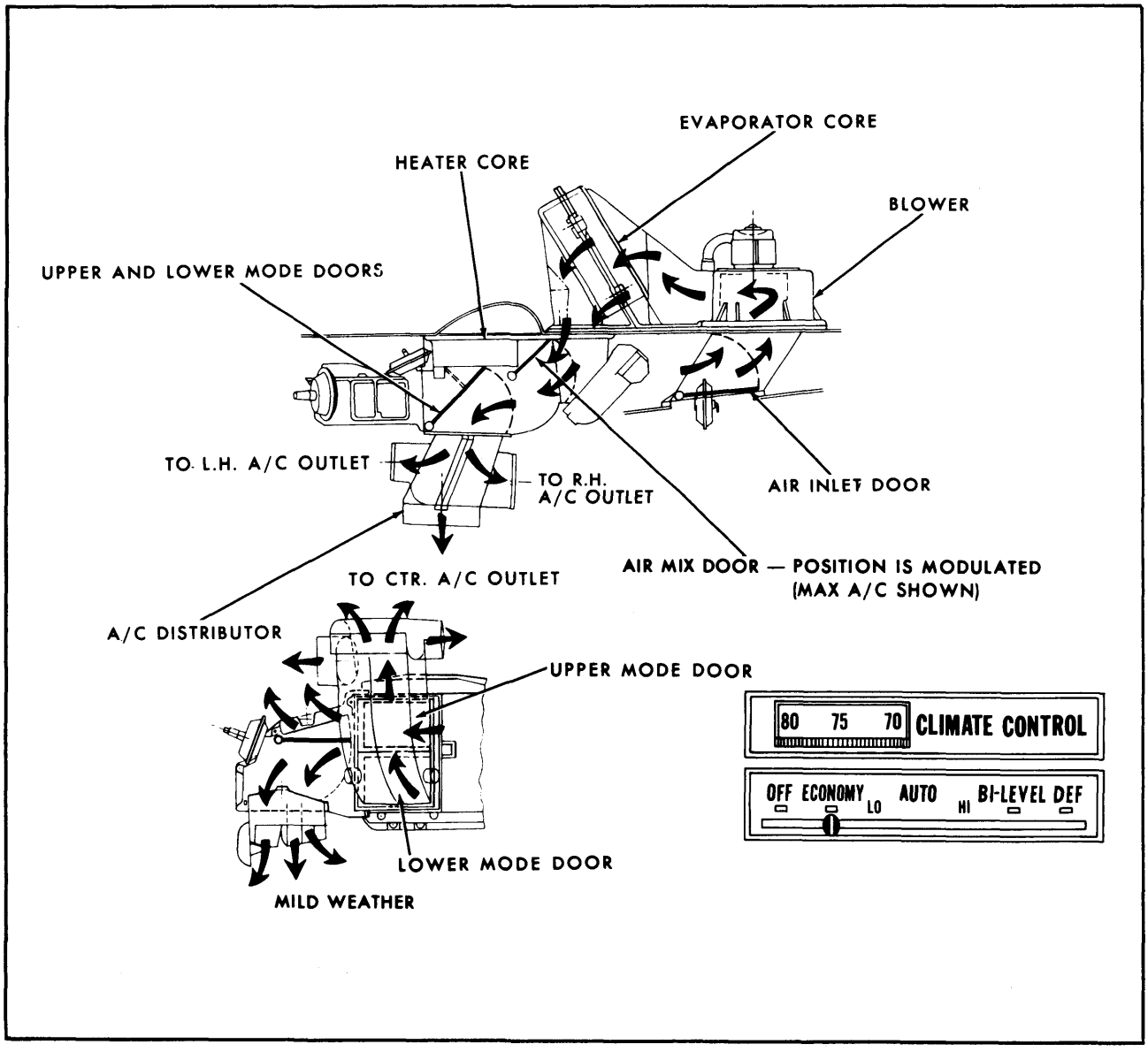


Fig. 1-24 Air Flow at "ECONOMY"

Economy

Outside air is circulated at an automatically selected blower speed through the evaporator the heater assembly and discharged into the passenger compartment from the air conditioning or heater outlets. Since the compressor is disengaged at this setting, the ability of the system to maintain the dial temperature is restricted. It may be necessary to set the dial approximately 5° cooler than normal to maintain comfort at 50° to 70°F. ambient temperatures.

Four blower speeds, HI, MED_3, MED_2, and MED_1 are utilized. If the car interior is significantly hotter than the temperature on the dial, the blower will start at high and then sequence down to lower speeds as the dial temperature is approached. With a colder interior temperature, the blower will start at MED_3 and sequence down to lower speeds.

In the upper part of the usable range of this setting (approximately 50°F. to 70°F.) (10°C to 21°C) air is delivered from the air conditioner outlets. Below 50°F., air is delivered in BI-LEVEL fashion – from both the air conditioner and heater outlets or from the heater outlet only in cold weather. System turn on will be delayed, if the engine is cold, until engine coolant reaches approximately 130°F. (54°C).

The Economy setting is designed so that it is possible to maintain comfort at ambient temperatures below approximately 70°F. without having the compressor operate.

In some situations (high sunload or excessive humidity) this setting may not provide comfort or windows may tend to become fogged. Under these conditions, the control lever should be returned to the "AUTO" setting.

BACK TO INDEX

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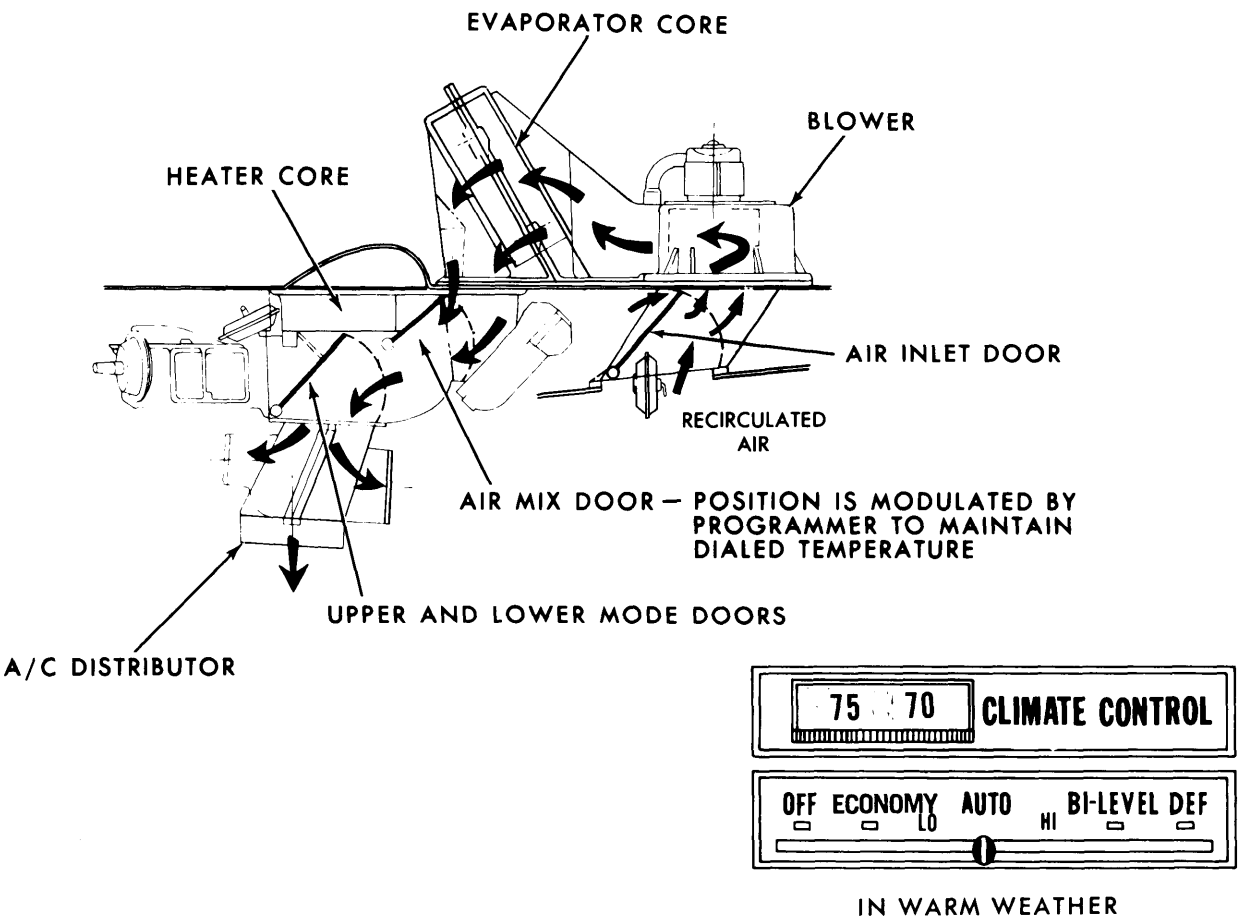


Fig. 1-25 Air Flow at "Auto" – Warm Weather

Lo

Operation at this setting is identical to that provided at "Auto" except that the blower operates at a fixed low speed with no turn on delay provision.

BACK TO INDEX

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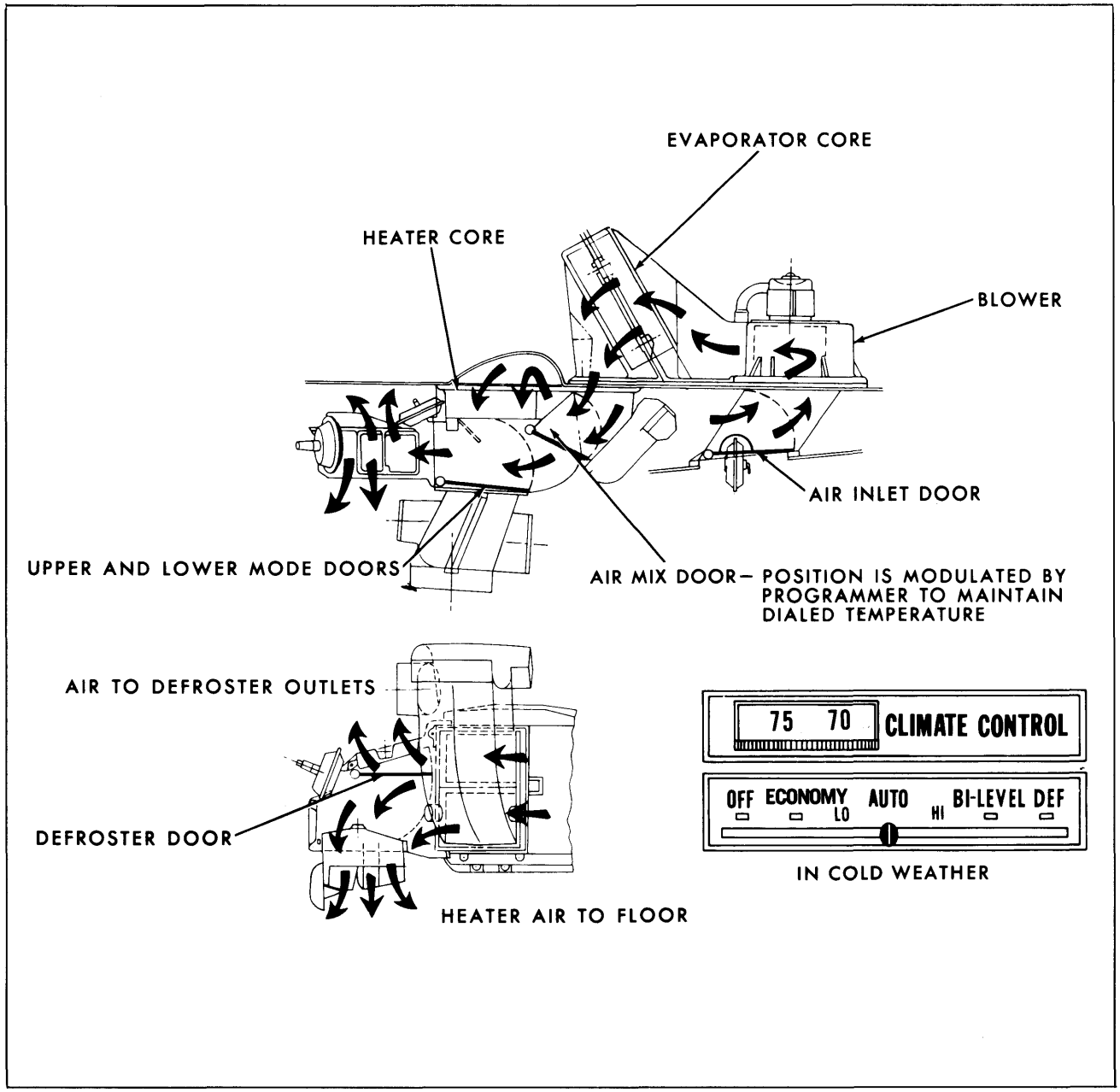


Fig. 1-26 Air Flow at "Auto" – Cold Weather

Auto

Regulation of blower speed, discharge air temperature, air delivery mode, system turn-on and compressor operation is accomplished automatically to maintain the temperature on the dial and to provide comfort.

Four blower speeds, HI, MED_3, MED_2, and MED_1 are utilized (three in heater mode). If the car interior is significantly hotter or colder than the temperature on the dial, the blower will start at high and then sequence down to lower speeds as the dial temperature is approached.

Discharge air temperature will be varied automatically between approximately 45° and 150° (7°C to 66°C). If the discharge air temperature is above approximately 90°, the air will be delivered from the heater outlet (Fig. 1-26); below approximately 75° (24°C) it will be delivered from air conditioner outlets. Between these temperatures, air is provided from both the heater and air conditioner outlets (Bi-Level operation).

If the car interior is above approximately 75°, the system will turn on immediately when the car is operated. If the car is below 75°, system turn-on will be delayed, if the engine is cold, until engine coolant reaches approximately 130° (54°C).

Compressor operation is provided at all ambient temperatures above approximately 32°F. (0°C) even when not required for cooling, to assure maximum dehumidification of the air.

Recirculated air is used when maximum cooling is required.

BACK TO INDEX

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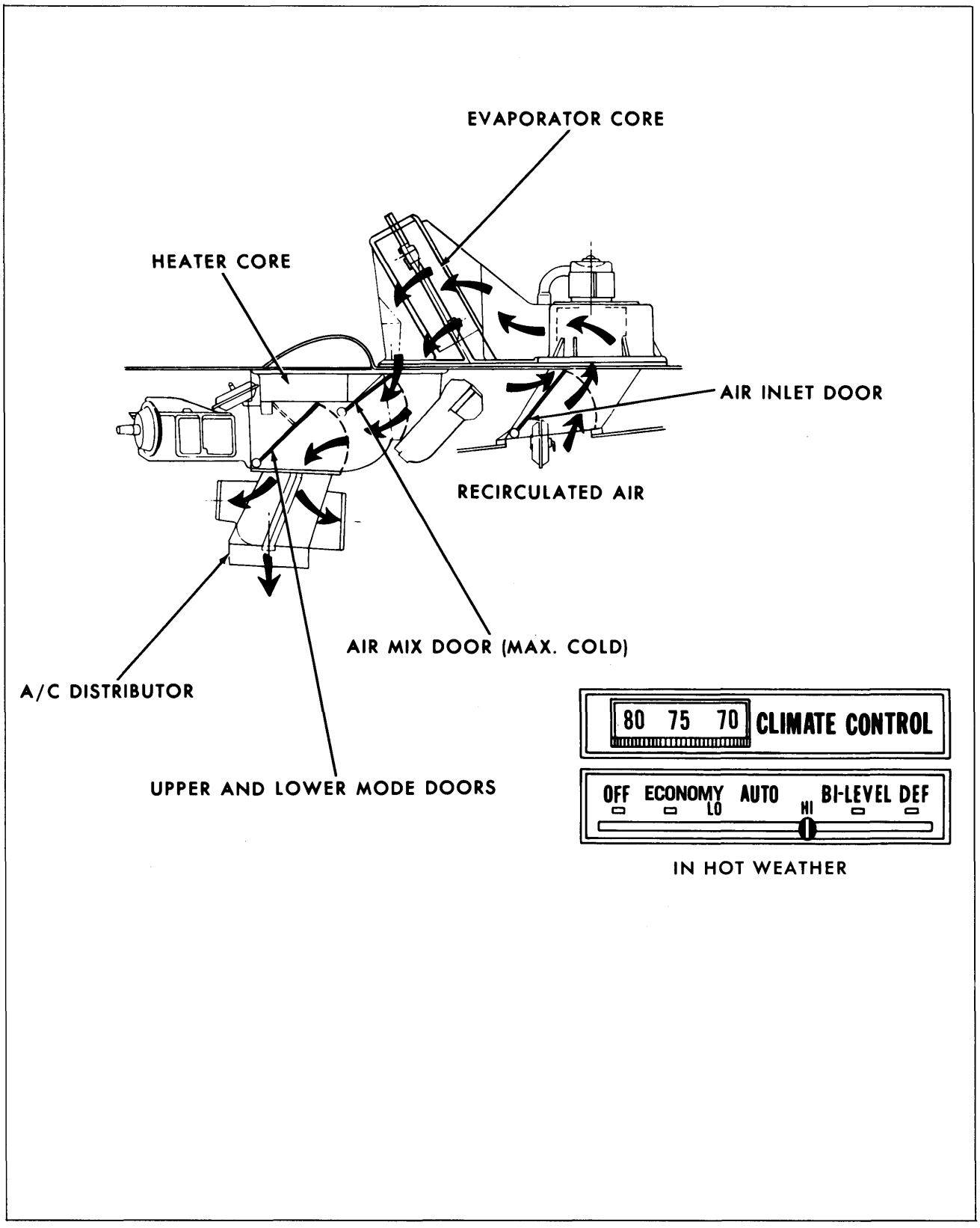


Fig. 1-27 Air Flow at "HI"

Hi

Operation at this setting is identical to that provided at "Auto" except that the blower operates at a fixed maximum speed. Recirculated air is used when maximum cooling is required. This setting is provided for quickest possible cool down under extremely hot ambient conditions.

BACK TO INDEX

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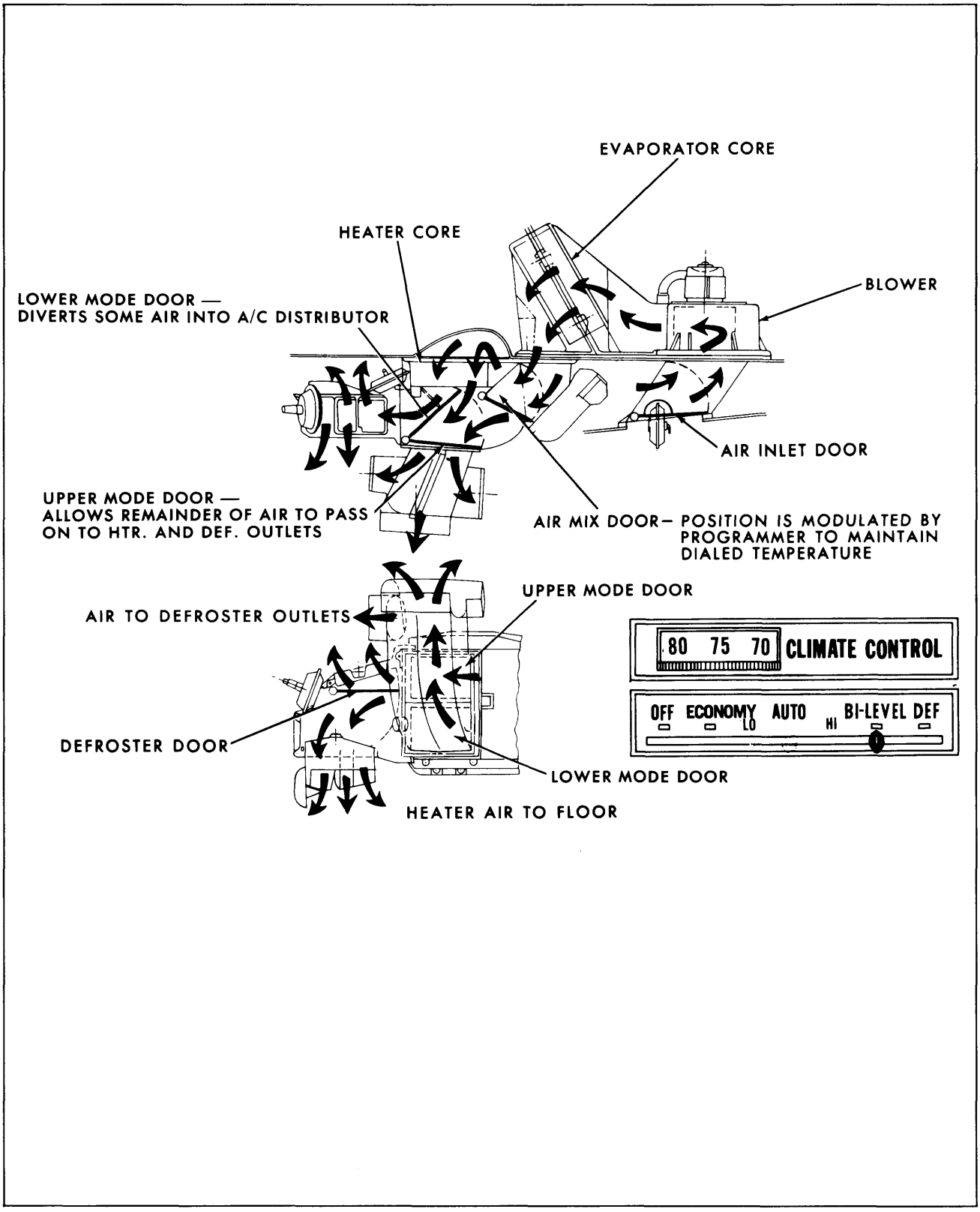


Fig. 1-28 Air Flow at "Bi-Level"

Bi-Level

Operation at this setting is the same as at "Auto" except bi-level air delivery is provided – approximately half the air is delivered from the heater outlet and the other half is discharged from the air conditioner outlets. This provides a pleasant, draf-free mode of operation in mild weather; it also permits defrosting of the side windows by the air streams from the end air conditioner outlets in cold weather.

BACK TO INDEX

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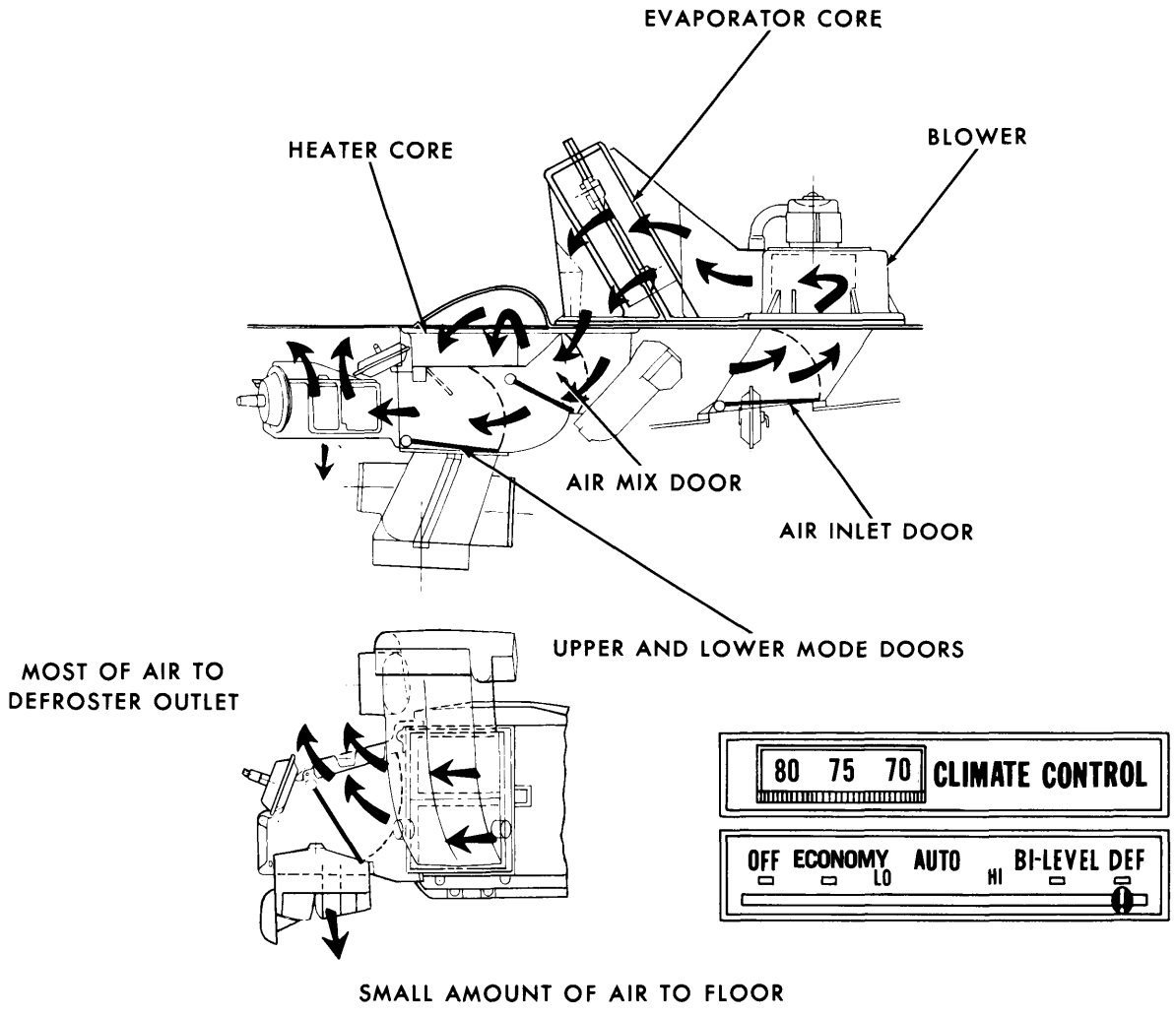


Fig. 1-29 Air Flow at "DEF"

Def

At this setting all the air is delivered to the windshield and the blower operates at a fixed high speed. Temperature regulation is maintained. Blower turn-on is immediate, even with a cold engine.

How the system operates at the various lever settings is depicted in organized fashion in the chart in Fig. 1-30.

BACK TO INDEX

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		SYSTEM RESPONSE							
		BLOWER SPEED	AIR INLET DOOR POSITION	TEMPERATURE DOOR POSITION	MODE DOORS POSITION	DEFROSTER DOOR POSITION	COMPRESSOR	HTR-WATER SHUT-OFF VALVE	IS BLOWER DELAYED FOR ENGINE WATER WARMUP?
CONTROL LEVER SETTINGS	OFF	FIXED LOW 5.0V – HTR 4.5V – A/C	OUTSIDE AIR	VARIES – RESPONSIVE TO SENSORS	FORCED TO HEATER	SEALED	DOESN'T OPERATE	USUALLY OPEN – EXC. CLOSED AT MAX. A/C POSITION OF PROGRAMMER	NO – BLOWER IS TURNED ON BY O'RIDE SW.
	ECON.	VARIABLE BLOWER PROGRAM			EITHER HEATER, BI-LEVEL OR A/C DEPENDS ON PROGRAMMER POSITION	DOOR WILL ASSUME "BLEED" POSITION AFTER 45 SECOND DELAY AND WILL DELIVER BLEED AIR TO W/S IF IN HEATER OR BI-LEVEL MODE			YES – SAME CONDITIONS AS IN "AUTO"
	LO	FIXED LOW 5.0V – HTR 4.5V – A/C					OPERATES ABOVE APPROX. 37° (3°C)		NO – BLOWER IS TURNED ON BY O'RIDE SW.
	AUTO	VARIABLE BLOWER PROGRAM	RECIRCULATE AIR WHEN PROGRAMMER IS AT MAX. A/C - OTHERWISE OUTSIDE AIR						YES – EXCEPT WHEN CAR INTERIOR IS WARM, IN WHICH CASE IN-CAR SWITCH ON CONTROL HEAD TURNS BLOWER ON IMMEDIATELY, EVEN IF ENGINE IS COLD.
	HI	FIXED HI - 13.5 V							
	BI-LEVEL	VARIABLE BLOWER PROGRAM			BI-LEVEL			OPEN	
	DEF	FIXED HI - 13.5 V			FORCED TO HEATER	FULL OPEN TO W/S			NO – BLOWER IS TURNED ON BY O'RIDE SW.

Fig. 1-30 System Operation at Various Settings

BACK TO INDEX

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BLOWER CIRCUIT AT VARIOUS LEVER SETTINGS

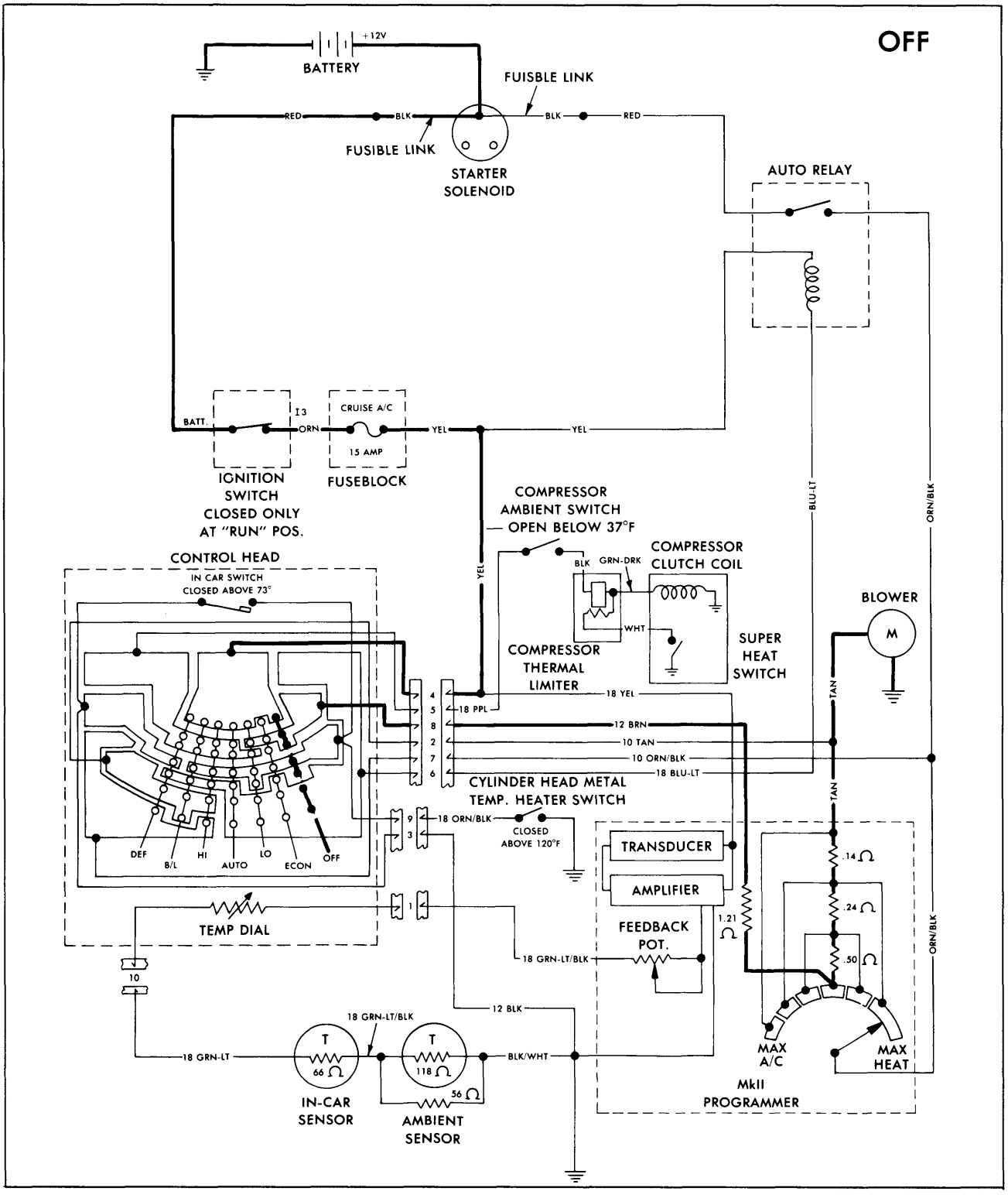


Fig. 1-31 Blower Operation at "OFF"

Blower Operation at "Off" (Fig. 1-31)

When the ignition switch is closed, current flows through the fuse block, control head, lo blower resistors to ground at the blower motor. Blower current flows through all four resistors in the programmer to the blower motor which operates at low speed. Movement of the programmer has no affect on blower speed.

BACK TO INDEX

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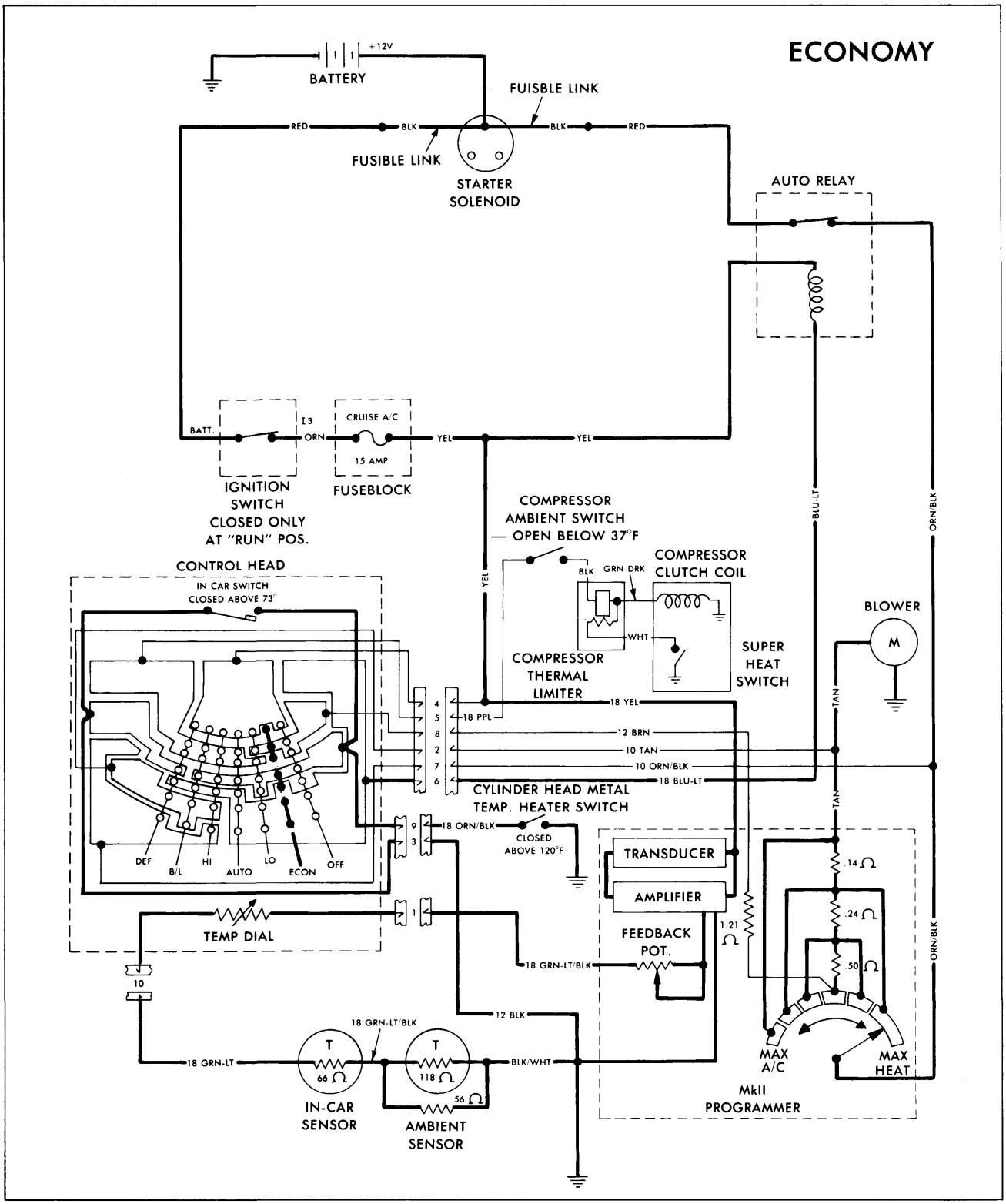


Fig. 1-32 Blower Operation at "Economy"

Blower Operation at "Economy" (Fig. 1-32)

Current flows through the ignition switch and fuse block to the auto relay coil and to ground through either the engine temperature switch or the in-car switch. There is no grounding connection on the control head circuit board switch for the auto relay so that multiple blower speeds will delay in cold weather. Blower current flows through the fusible link to the center point of the wiper on the programmer and through none, one, two or three resistors, depending on the position of the programmer, to the blower motor and after 130°F. (54°C) coolant temperature.

BACK TO INDEX

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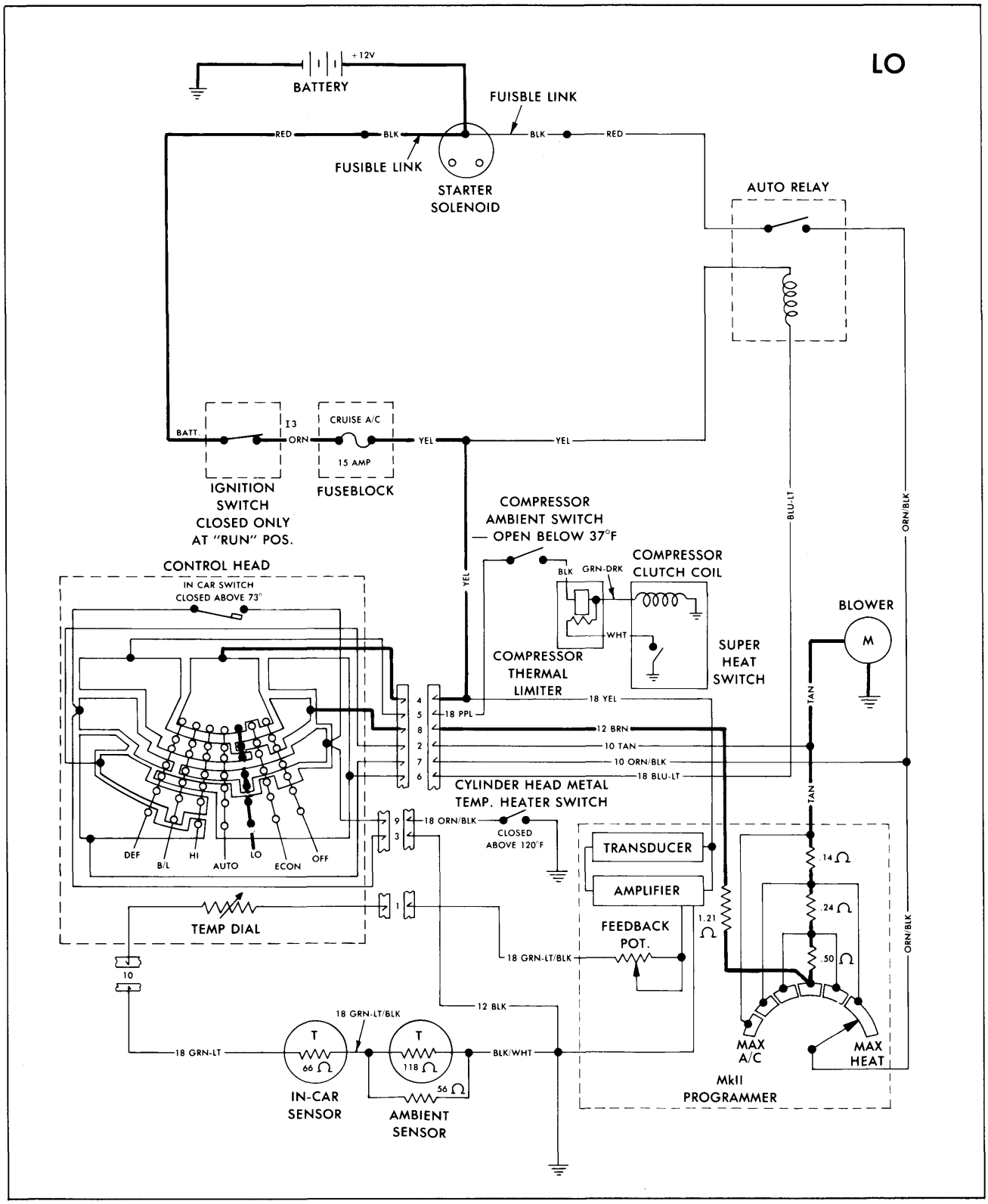


Fig. 1-33 Blower Operation at "LO"

Blower Operation at "Lo" (Fig. 1-33)

When the ignition switch is closed, current flows through the fuse block, control head, lo blower resistors to ground at the blower motor. In cold weather the blower will operate at low speed regardless of engine coolant temperature. Blower current flow through all four resistros in the programmer to the blower motor which operates at low speed. Movement of the programmer has no affect on blower speed.

BACK TO INDEX

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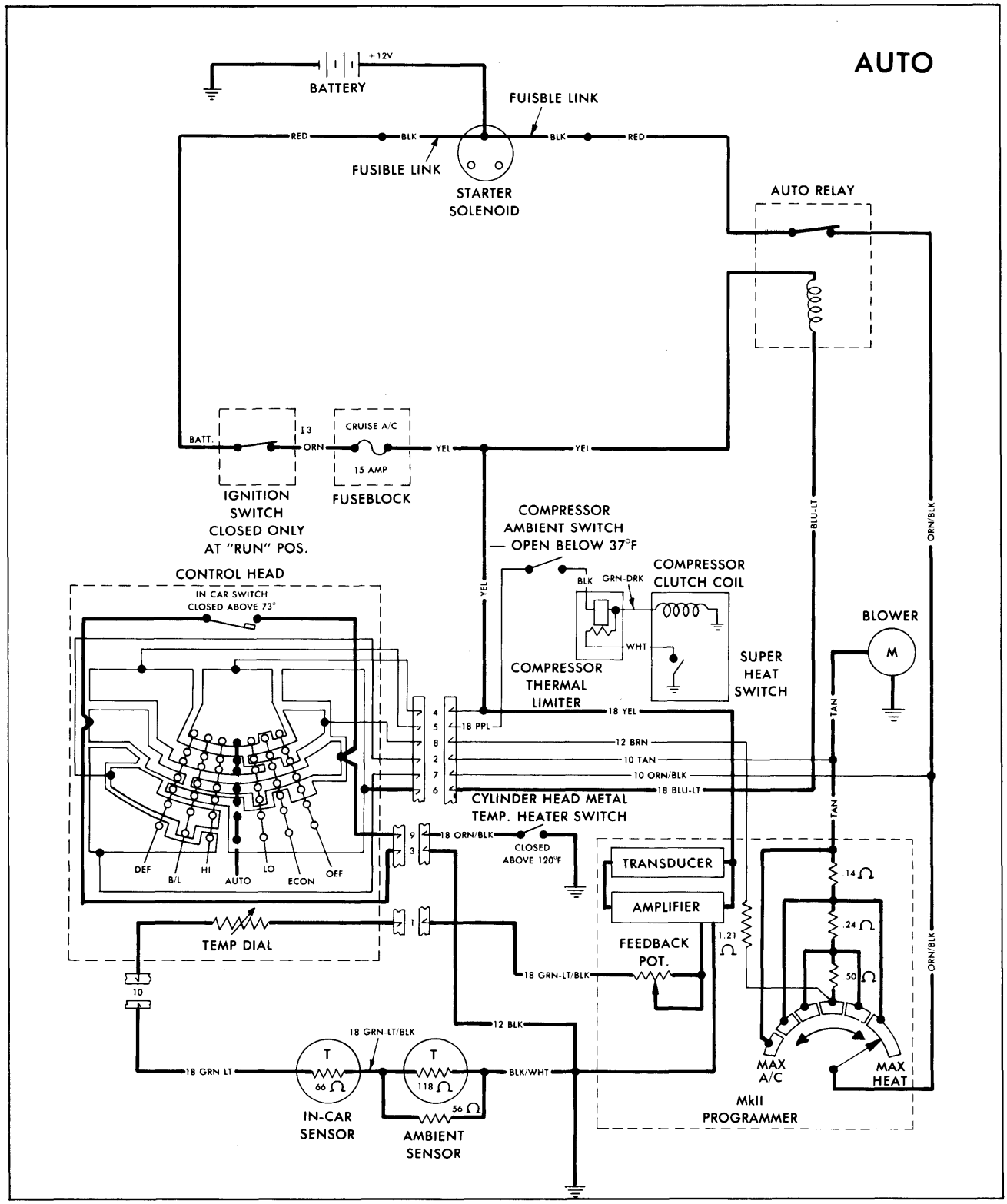


Fig. 1-34 Blower Operation at "Auto"

Blower Operation at "Auto" (Fig. 1-34)

Current flows through the ignition switch and fuse block to the auto relay and to ground through either the engine temperature switch or the in-car switch. There is no grounding connection on the control head circuit board switch for the auto relay so that multiple blower speeds will delay in cold weather. Blower current flows through the fusible link to the center point of the wiper on the programmer and through none, one, two or three resistors, depending on the position of the programmer, to the blower motor and after 130°F. (54°C) coolant temperature.

BACK TO INDEX

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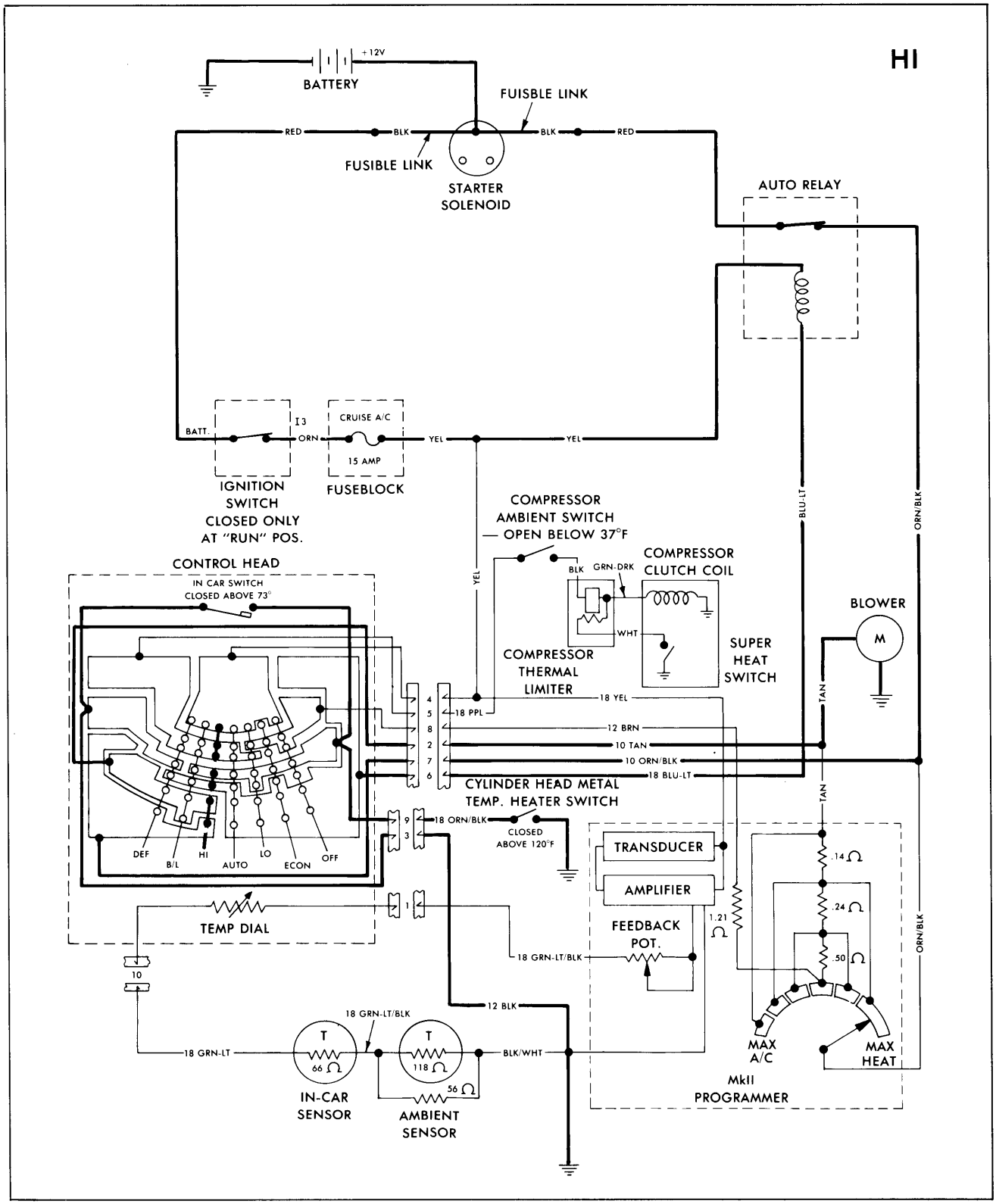


Fig. 1-35 Blower Operation at "HI"

Blower Operation at "Hi" (Fig. 1-35)

Current flow through the auto relay coil circuit is the same as at "Auto". Blower current, however, does not go through the programmer but is routed through two inter-connected pads on the control head directly to the blower motor. There is no resistance in the circuit so that the blower operates at a fixed high speed, with no programmer control over its operation.

BACK TO INDEX

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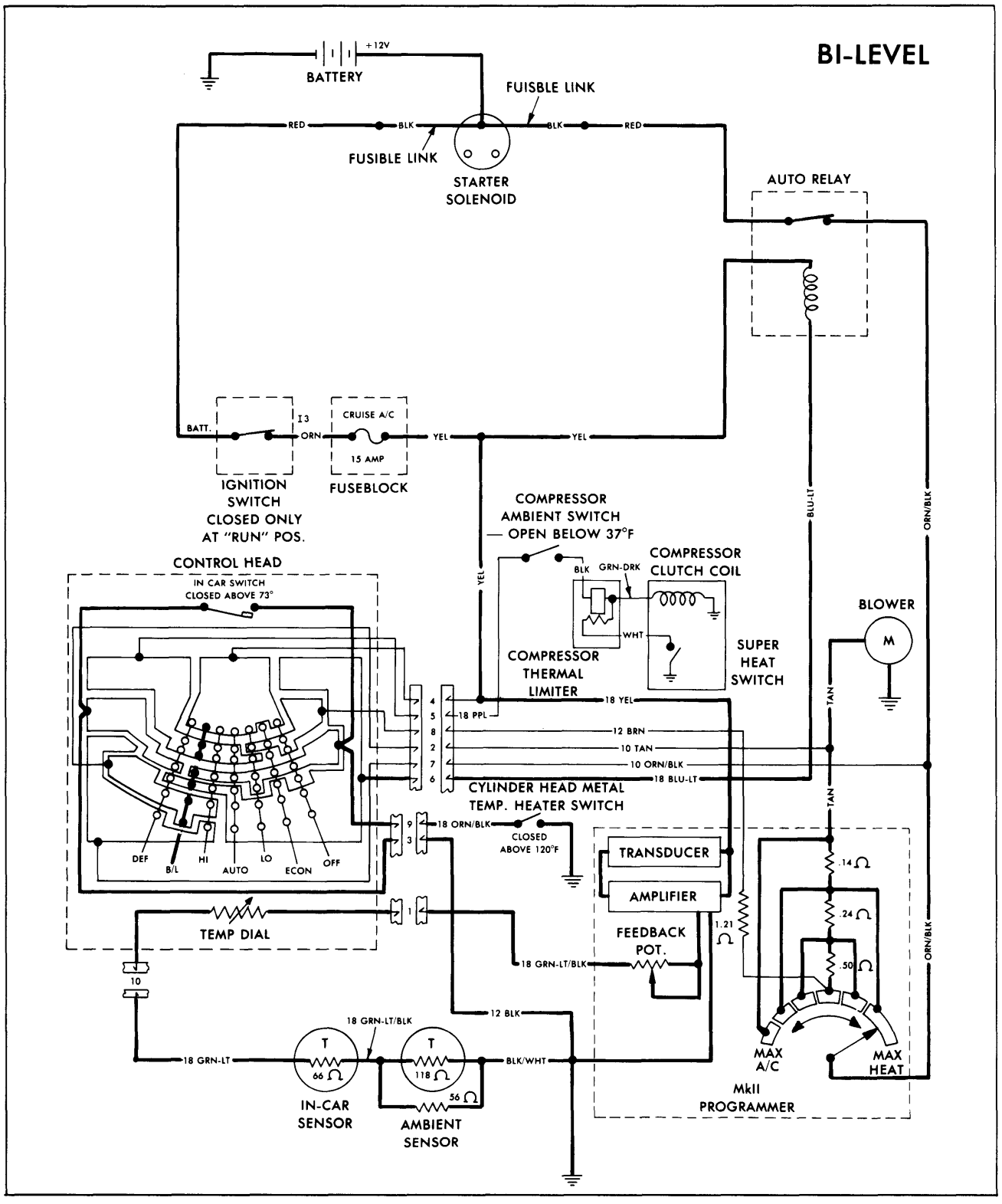


Fig. 1-36 Blower Operation at "Bi-Level"

Blower Operation at "Bi-Level" (Fig. 1-36)

Current flows through the ignition switch and fuse block to the auto relay and to ground through either the engine temperature switch or the in-car switch. There is no grounding connection on the control head circuit board switch for the auto relay so that multiple blower speeds will delay in cold weather. Blower current flows through the fusible link to the center point of the wiper on the programmer and through none, one, two or three resistors, depending on the position of the programmer, to the blower motor and after 130°F. (54°C) coolant temperature.

BACK TO INDEX

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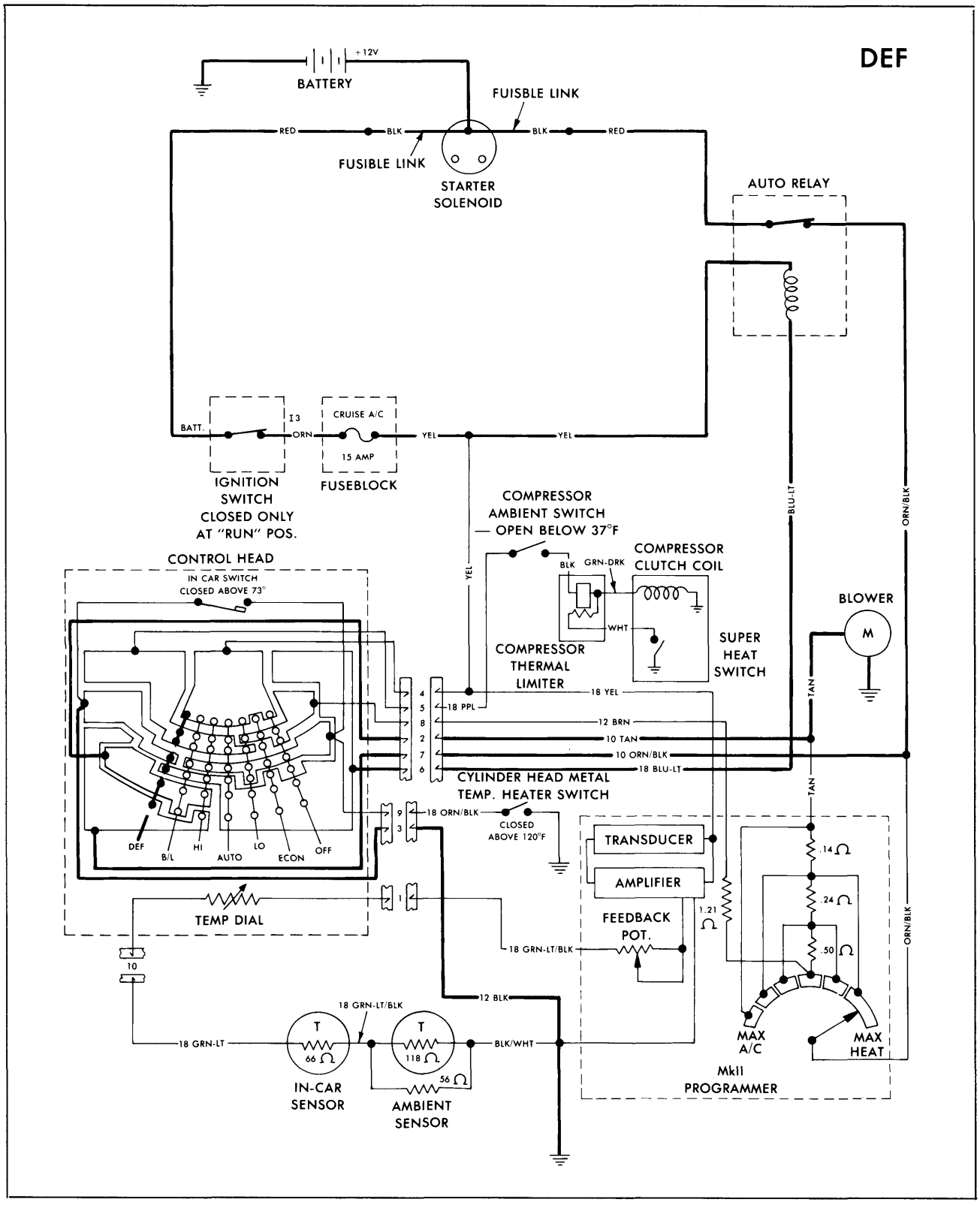


Fig. 1-37 Blower Operation at "DEF"

Blower Operation at "Def" (Fig. 1-37)

The Auto Relay Coil is grounded through two pads on the control head so that there is immediate turn-on even with a cold engine. Blower current flows to two inter-connected pads on the control head and on the blower. The blower operates at a fixed high speed.

BACK TO INDEX

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DIAGNOSIS OF PROBLEMS — FRONT A/C — ALL SERIES

1. How to Isolate the Problem

To diagnose an air conditioner problem in the shortest time and with the least effort, it is essential to follow a logical service procedure. Time spent in conducting a system functional performance test and analyzing the malfunction in order to isolate it to a specific control function area will be repaid in reduced repair time. A recommended diagnosis procedure follows:

STEP 1 - Attempt to get an accurate, detailed description of the owner's complaint in writing on the repair order. "A/C inop." or "erratic operation" do not provide much information to the repairman.

STEP 2 - To confirm the system malfunction make a brief check of system operation by sitting in the car and operating the controls, with the engine warmed up and running at 1000 RPM or higher, in the following sequence:

AUTOMATIC TEMPERATURE CONTROL FUNCTIONAL TEST	
CONTROL SETTING	**SYSTEM SHOULD OPERATE AS FOLLOWS**
"DEF" DIAL @ 85°	Air should be delivered out of defroster outlets at a fixed high blower speed. Some floor bleed out heater.
"BI-LEVEL" DIAL @ 85°	Air should be delivered from both the A/C and heater outlets at a reduced blower speed. Only a small portion of air will come out the defroster outlet.
"HI" DIAL @ 65°	Air should be delivered out the A/C outlets at a fixed high blower speed and cool to cold temperature. The recirculating air door should open (blower noise increases). Door movement will be slow because of vacuum delay porous plug.
"AUTO" DIAL @ 85°	Blower speeds should drop (Hi-M_3-M_2-M_1- etc.). Recirc air door should close (noise level will drop). Discharge air temperature should increase. Depending on the temperature in the work area, the air delivery mode should change from the A/C outlets to the heater outlets.
"LO" DIAL @ 85°	Air should be delivered at a fixed low blower speed with immediate turn on regardless of engine coolant temperature.
"ECONOMY" DIAL @ 65°	Blower speeds should increase (M_1-M_2-M_3- etc.) Depending on the temperature in the work area, the air delivery mode should change from the heater outlets to both heater and A/C outlets of the A/C outlets only. The A/C compressor should not operate.
"OFF" DIAL @ 65°	Air should be discharged out the heater outlet at a fixed low blower speed. No A/C compressor operation. Blower will turn on immediately regardless of engine coolant temperature.

During the above tests, be sure to note the following:

a. Check to assure that air delivery is not coming from both the A/C and heater outlets when only one mode is indicated. A split air delivery is indicative of a vacuum leak.

b. Note whether program events (air delivery mode change, blower speed change, recirc air, etc.) occur without change in discharge air temperature. This would indicate the programmer is operating without moving the temperature air door. Check the air mix door link to programmer connection.

c. If neither the program events nor the discharge air temperature change, an incorrect vacuum or electrical signal to the programmer or a programmer malfunction is indicated.

d. Malfunction of a specific vacuum operated door function could indicate a vacuum disconnect of the vacuum diaphragm at that door. See illustrations for locations of the different function doors.

STEP 3 - Perform the easiest checks first! A simple, visual inspection of the easily accessible underhood and instrument panel electrical and vacuum connections will, in many instances, reveal the problem on the spot. The areas indicated in Fig. 1-38 can be inspected without removing any car parts: It may be necessary to remove the lower steering column cover to inspect control head.

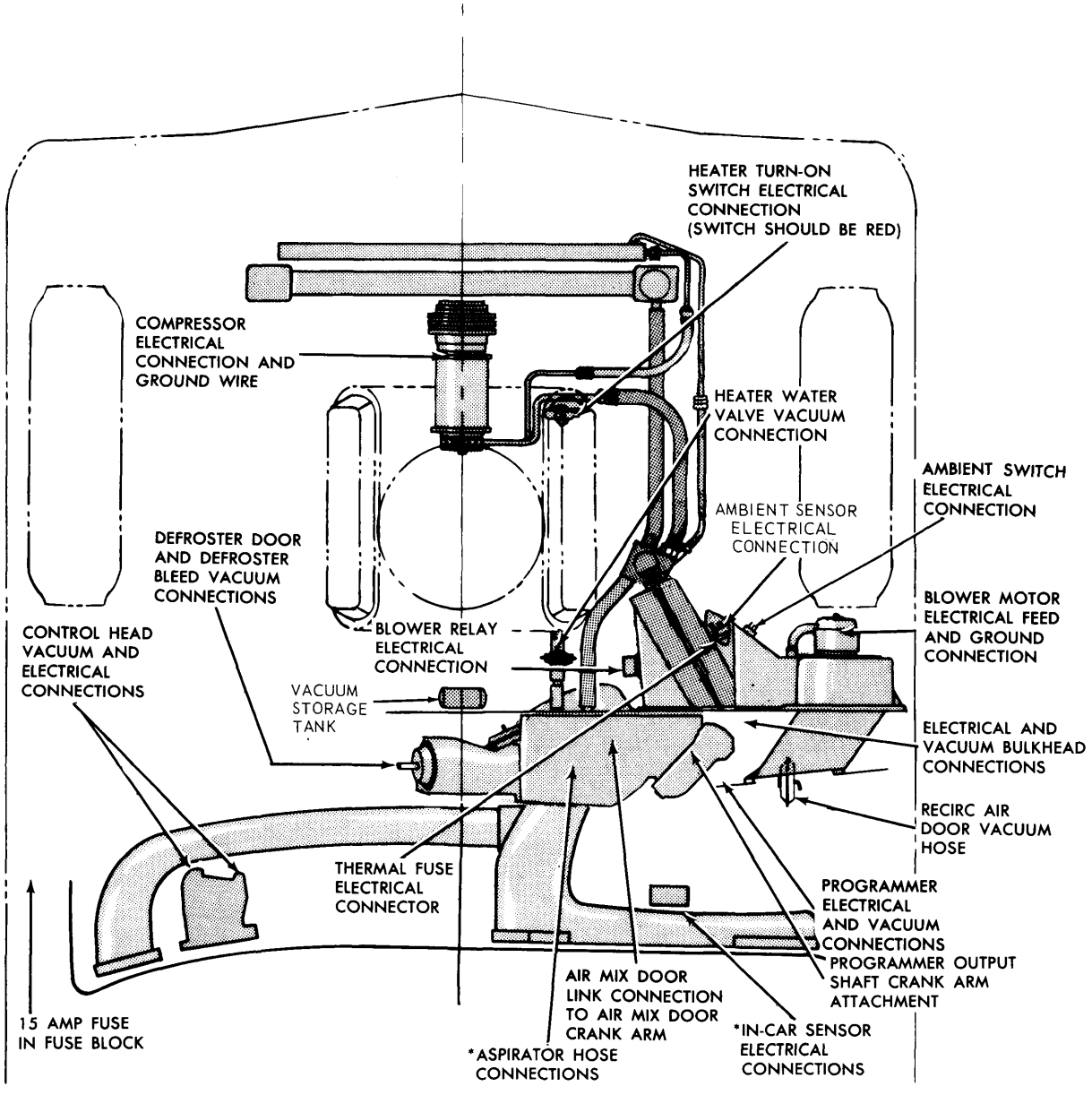
STEP 4 - Based on information gained during the functional test performed in step 2, try to relate the problem to one of the following areas:

1. Temperature Control Problems
2. Blower Control Problems
3. Auxiliary Vacuum Problems
4. Refrigeration System Problems

Once a problem has been isolated to one of the areas listed above, refer to that diagnosis section on the following pages. Diagnosis charts and control circuit illustrations are provided. It is of special importance to be familiar with the general description of the major sections of the system as presented in the Theory of Operation section beginning on page 1-2.

BACK TO INDEX

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*REMOVE GLOVE BOX LINER FOR AXCESS

Fig. 1-38 Diagnosis Areas

BACK TO INDEX

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STEP 5 - After the problem has been properly diagnosed and the repair made, it is important to run through the brief check listed in Step 2 in order to assure that the system is now performing correctly.

2. Temperature Control Problem Diagnosis

The primary function of the temperature control circuit is to determine the correct temperature of the air to be discharged into the passenger compartment and to set the air mix door position to accomplish that function The signal used for this purpose (vacuum to position the programmer vacuum motor) is also used in the blower speed control circuit, and the auxiliary vacuum function circuit. Those uses may be disregarded when dealing with problems which relate only to the temperature control circuit.

Examples of temperature control problems are: "System operates at maximum air conditioning (no heat) or only at maximum heating (no air conditioning)", "Temperature dial does not provide comfort", "Poor heating or poor cooling". Blower cycling and mode cycling are also caused by a malfunction in the temperature control circuit.

It is important to separate temperature control circuit problems from refrigeration or heater circuit problems. If the complaint is "poor" or "no" heating or cooling and the programmer moves to both extremes of travel with the air mix door and program functions known to follow, the problem probably lies in the refrigerant or heater water circuits. Refer to pages 1-50 and 1-51 later in this section.

Many temperature control problems result from poor electrical or vacuum line connections. The following relationships may aid diagnosis:

- A disconnected sensor or temperature dial interrupts the electrical signal and drives the programmer to maximum heating.
- A poor sensor connection adds resistance to the sensor string driving the system hotter.
- An open amplifier power feed eleiminates the output signal and drives the programmer to maximum A/C.
- A disconnected vacuum hose supplying the vacuum checking relay actuating nipple will lock the relay in an intermeidate position.
- A disconnected vacuum hose in the transducer - programmer vacuum motor line will drive the system to maximum cooling.
- A leak in the auxiliary vacuum circuit may reduce the transducer vacuum supply level below control requirements, causing an "off-calibration" or "poor heating" type complaint.
- A loss of supply vacuum usually results in cold air flow on the floor.

Diagnosis of most of the problems encountered in the temperature control circuit will be greatly aided by use of tester, J-23678 (use Harness Adapter J-24774 to connect to programmer and harness). Information on how to use the A.T.C. Tester is provided on the tester cover. Mk II programmer equipped systems must use instructions J-23678-50A which are provided with the tester and also printed on pages 1-43 and 1-44.

Specific problems and probable causes are as follows:

SYSTEM OPERATES ONLY AT MAXIMUM AIR CONDITIONING

This can be a vacuum or electrical problem. The problem can be separated into problems of erroneous signal external to the programmer or internal programmer malfunctions. With the system operating, disconnect the ambient sensor electrical connector, and observe the programmer movement through the slot at the bottom of the programmer cover. If the programmer remains in the maximum air conditioner position, remove the multiple vacuum connector and check for supply vacuum at the black hose. If no (or low) vacuum supply, check for leaks or disconnects in vacuum hose assembly. If vacuum supply is okay, programmer is malfunctioning. Remove programmer cover and inspect for obvious disconnects. If no programmer problem is obvious, use Tester J-23678, Adapter Harness J-24774 and instructions J-23678-50A to analyze and correct problem.

If the programmer moved to the maximum heater position when the electrical connector was removed, the problem is external to the programmer. Check the following items:

1. Shorted in-car sensor or ambient sensor.
2. Shorted or miscalibrated temperature dial.
3. A short in the sensor circuit of the wiring harness.
4. Disconnect or open in ground circuit (black wire) between control head and programmer.
5. No electrical power to programmer (yellow wire).
6. No ground at amplifier.
7. Malfunction within programmer assembly.

Use Tester, J-23678, Adapter Harness J-24774 and instructions J-23678-50A to analyze and correct the above problems.

BACK TO INDEX

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SYSTEM OPERATES ONLY AT MAXIMUM HEATING

This is usually an electrical problem either internal or external to the programmer. Investigate the following areas:

1. Disconnected or malfunctioning in-car sensor.
2. Disconnected or malfunctioning ambient sensor.
3. Open circuit or backed-out terminal in the wiring harness sensor string circuit.
4. Disconnected or malfunctioning temperature dial.

SYSTEM FLUCTUATES BLOWER SPEEDS and/or MODE SHIFTS DURING ACCELERATION

1. Malfunctioning vacuum checking relay (inside programmer).
2. Leaking programmer vacuum motor.

It is possible to distinguish between the two above items. With the system operating and the programmer cover removed, reinstall the vacuum and electrical connectors, and perform the following steps:

a. Remove the ambient sensor connector to force the programmer to maximum heating (full vacuum).

b. Remove the vacuum hose assembly connector. The programmer should remain in the maximum heat position. If it does not, repeat Step a, and then pinch the programmer vacuum motor supply hose with a pair of needle-nose pliers. If the programmer still moves, the vacuum motor is leaking. If the programmer does not move, the checking relay is malfunctioning.

c. If the original complaint was mode shifts without blower change, the check valve portion of the checking relay is probably malfunctioning.

DIAL SETTING DOES NOT PROVIDE COMFORT

The best approach to solving problems of the "off calibration" variety, is to use Tester, J-23678, Adapter Harness J-24774 and instructions J-23678-50A to check and reset calibration on all of the following parts (see Note 15):

1. The temperature dial.
2. The feedback potentiometer in the programmer.
3. The temperature door link adjustment.
4. The sensor string.

(NOTE: Check to assure that in-car sensor aspirator hose is attached at both the in-car sensor and the aspirator and not kinked in routing.)

Refer to the instruction sheet included with the Tester or the section on System Adjustments for procedures on checking and calibrating the above items.

BLOWER CYCLING AND MODE CYCLING

Erratic system performance may be caused by poor electrical connections, "cold" solder joints, or a malfunctioning sensor or amplifier. The problem may be intermittent and occur from the shock of going over road bumps. Such a problem may be accompanied by a clicking or buzzing of the transducer. To isolate the problem area, "rap" the areas around the sensors, control head, and programmer, and shake the wires attached to those areas. Listen for buzzing or clicking of the transducer. If the problem cannot be pinpointed by transducer buzzing, remove the programmer cover, (reinstall the vacuum and electrical connectors) and attach a good voltmeter to the transducer output terminal (grey wire). Repeat the rapping and wire shaking, and observe the voltmeter for violent, erratic voltage fluctuations. Replacement of parts or resoldering of terminals may be necessary. The sensors may be individually checked to the sensor resistance curve, Fig. 1-39.

(NOTE: Some system cycling may also occur and is normal if the temperature dial is moved in large increments. Instruct owner of this, and explain system operation.)

INSUFFICIENT HEATING OR COOLING

This problem may be caused by a control system malfunction or by the refrigerant or heater systems. Determine first which area to pursue:

1. Check for compressor clutch actuation (no cooling). If not operating, refer to Note 6 for diagnosis of low refrigerant detection system.
2. Check for clear sight glass and cold suction line (no cooling).
3. Check engine coolant level (no heating).
4. Check temperature of heater hoses by feel with engine hot to see if hot water is entering the heater core (no heating).

BACK TO INDEX

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5. Check for proper air flow at the "Auto" and "Hi" lever settings. (Improper air flow may be a blower relay problem, a blocked air passage, or a disconnected air hose.)

If a refrigeration problem exists, refer to the refrigeration diagnosis section in Note 5. If the problem appears to be caused by the temperature control system, locate problem area using Tester, J-23678, Adapter Harness J-24774 and directions J-23678-50A or as specified elsewhere in this section. Also check air mix door link adjustments.

BLOWER SPEEDS AND MODE SHIFT OCCURS WITHOUT TEMPERATURE CHANGE

Check connection of air mix door link to programmer shaft and to air door crankarm.

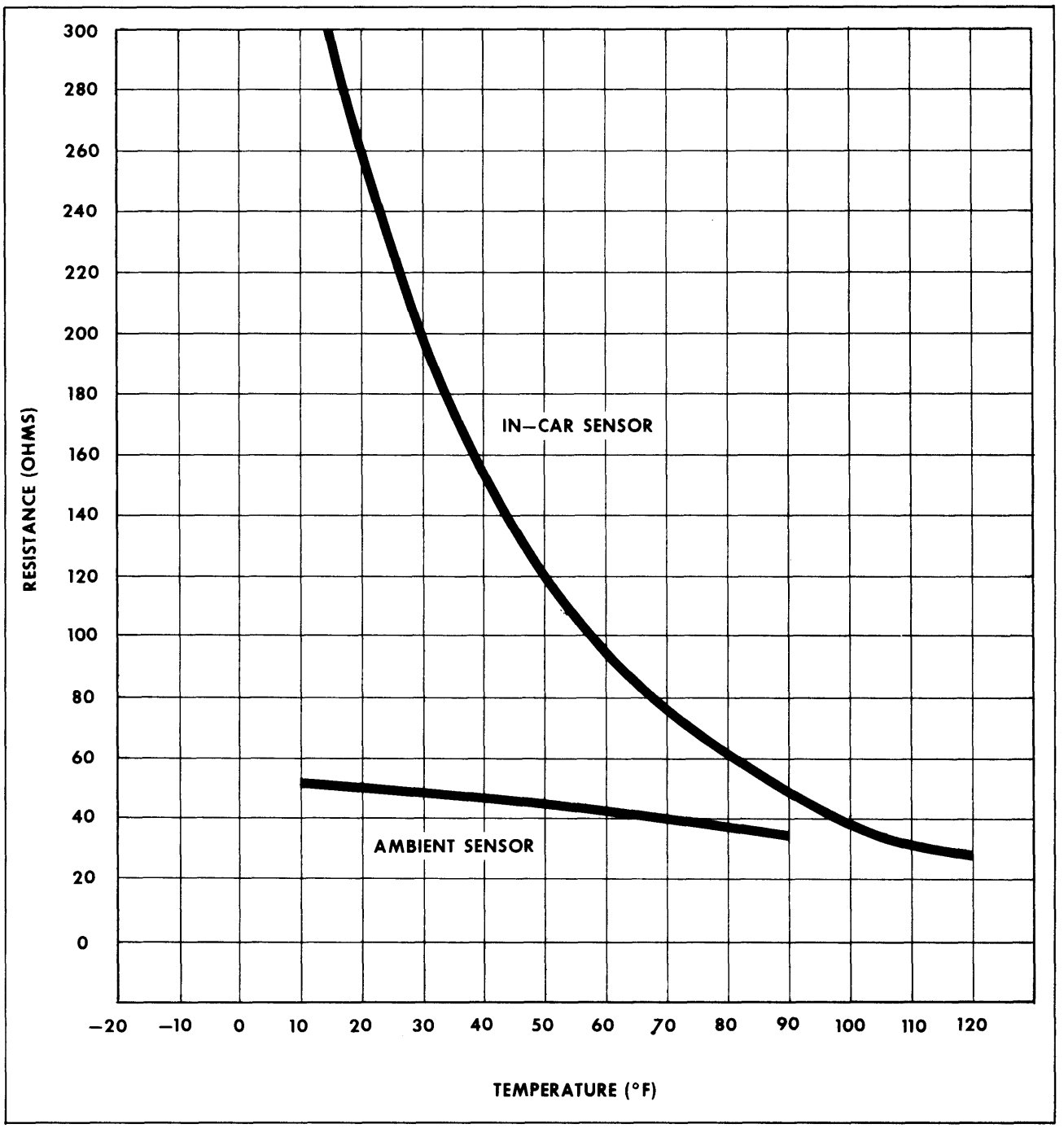


Fig. 1-39 Resistance Values of Sensors

BACK TO INDEX

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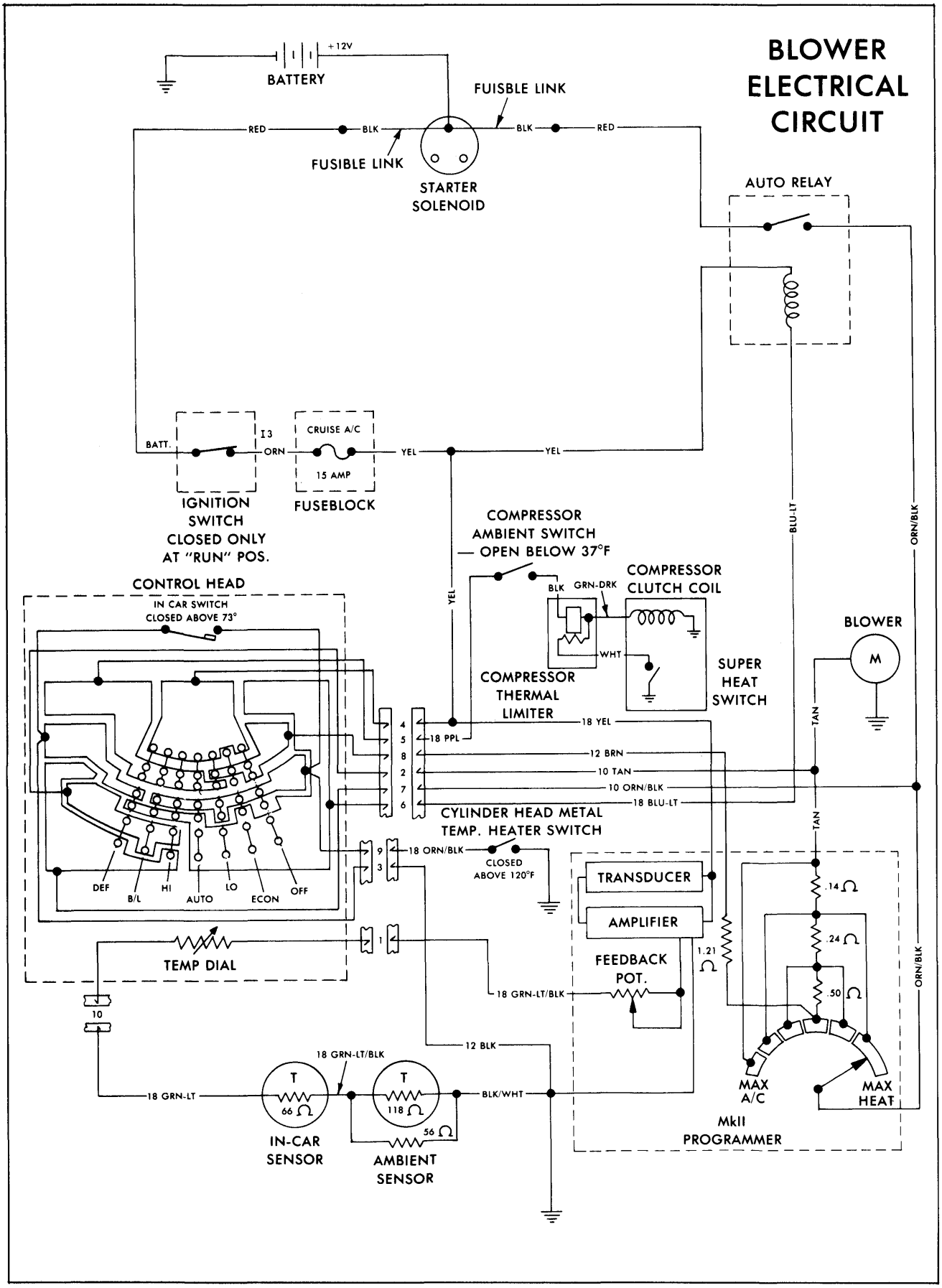


Fig. 1-40 Blower Control Circuit

BACK TO INDEX

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SYSTEM FUNCTIONAL TEST – ALWAYS START DIAGNOSIS WITH THIS TEST
MK II PROGRAMMER WITH COMBINED AMPLIFIER-TRANSDUCER

SET CONTROL AT:	SYSTEM SHOULD OPERATE AS FOLLOWS (ENGINE RUNNING – 70° - 80° GARAGE
DEF ..... 85°	Fixed high blower – most of air delivered from defroster outlets - some air from heater outlet – instant blower turn on.
BI-LEVEL ..... 75°	Lower blower speed – cooler air from both A/C and HTR outlets – only very small amount of air out defroster.
HI ..... 65°	Fixed high blower – cold air from A/C outlets – recirc should occur (will take approx. 3 min. on some cars because of restrictor in hose.
AUTO ..... 65°	No recirc – door will approx. take 5 min. on some cars
AUTO ..... 85°	before outside air enters.
LO ..... 85°	Blower should drop to fixed low speed.
ECON ..... 85°	No compressor operation, otherwise same as AUTO.
OFF ..... 85°	Fixed low blower – warm air out heater outlets – no air out A/C or defroster ducts – no compressor operation.

PROGRAMMER FUNCTIONAL TEST

1. Connect tester electrical harness to programmer and car harness to tester. Use harness adapter No. J-24774.
2. Operate car at idle – approx. 1000 RPM.
3. Set control head lever at auto.
4. Turn temp dial calibration switch off.
5. Place manual-automatic switch in manual position.

(NOTE: This substitutes variable resistor for sensor string at all control head settings.)

6. Place the manual control at max. heat and then rotate slowly counter-clockwise. The vacuum motor mechanism which can be seen through the slot in the programmer cover should start moving at 175 OHMS. Rotating the knob to max. cold should move the programmer to its full A/C position. Check air mix door for full travel and no obstructions. If the programmer operates in this manner, the components governing programmer movement – amplifier, transducer and vacuum motor – are OK. Proceed to sensor string test.
7. If the programmer moves but the movement does not start at 175 OHMS, adjust feedback pot per procedure on the next page.
8. If the programmer does not move check as follows for supply voltage and supply vacuum:
   a. Place voltmeter switch in 2 position. Battery voltage should appear on meter. No voltage indicates lack of ground on Term. 1 or battery supply to Term. 2 of programmer.
   b. Plug testers dummy vac plug on programmer valve. Connect dummy hose to vac supply (port 2 hose in car vacuum harness). Make sure vac is present (11 in. hg. or more). Programmer now has vac supply with no car vac system components connected. If programmer functions using manual control, troubleshoot car vac system. If programmer does not function problem is in programmer. See next page.

SENSOR STRING TEST (MUST PASS PROGRAMMER FUNCTIONAL TEST FIRST)

(NOTE: Do not perform sensor string test on car which has been run at idle for a long period of time in a heated building. This condition produces sufficient engine heat to heat the ambient sensor and cause lower resistance readings than specified in the procedure even though no problem exists in the sensor string.)

1. Set control lever at auto and temperature dial at 75.
2. Place temp dial calibration switch at off.
3. Place manual-automatic switch at automatic position.
4. Observe position of vacuum motor mechanism through slot in programmer cover.
5. Switch to manual and adjust manual control for same mechanism position.
6. When manual control is properly adjusted moving manual-automatic switch back and forth will not move vacuum motor.
7. Read manual control. This indicates the resistance of the sensors and the temperature dial combined and should be 120 to 150 OHMS at 70° to 75° room temp.
8. If reading is not 120 to 150 OHMS perform the temperature dial calibration test to check out the temp dial. If temp dial checks OK, the in-car or ambient sensor or connecting wiring is the problem.

TEMPERATURE DIAL CALIBRATION (CONTROL LEVER IN ECON.)

1. Place control lever at economy.
2. Place manual-automatic switch in manual position.
3. Place calibration switch in cal. position.
4. Disconnect in-car sensor connector and plug connector into mating connector on tester harness adaptor (ground both sensor wires).
5. Read voltmeter.
6. Press pushbutton and adjust temp dial on control head to get same voltmeter reading as above.
7. Temp dial should read as indicated on tester panel near pushbutton. If it does not, slip temp dial clutch to correct.

   (NOTE: If same voltmeter reading cannot be obtained the temp dial is malfunctioning.)

8. Reconnect in-car sensor.

BLOWER CIRCUIT TESTS

1. Place calibration switch in off position.
2. Place manual-automatic switch in manual position.
3. Set control lever at LO using voltmeter knob. There should be battery voltage at 7 (approx. 11 volts) and approx. half-battery voltage at 6 (4.0 to 4.5 volts). If there is no voltage at 7, there is a problem in the LO blower circuit. If there is voltage at 7 but no voltage at 6 the programmer is malfunctioning.
4. Set control lever at auto. There should be battery voltage at 8 (approx. 11 volts) and the voltage at 6 should stairstep down and then back up as the manual control is rotated from max. heat to max. cold. If there is no battery voltage at 8, there is a problem in the auto relay circuit. If the voltage at 6 does not change as described, the programmer is malfunctioning.

   (NOTE: A good connection between 6 and the blower motor is assumed. If the blower wire is disconnected, only battery voltage will appear at 6.)

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DIAGNOSING MALFUNCTIONS IN PROGRAMMER. THE FOLLOWING TESTS SHOULD BE PERFORMED TO DETERMINE MALFUNCTIONING INTERNAL PART. TESTS SHOULD BE MADE IN THE NUMBERED SEQUENCE.

TEST 1 PROGRAMMER VACUUM CIRCUIT

Turn temp dial calibration switch off. Place manual-automatic switch in manual. Position manual control–max. heat. If programmer moves to max. heat position skip to Test 2, otherwise perform following test.

1. Remove programmer cover. Install dummy vacuum plug with vacuum gauge feed-in to port 2 of car harness plug.
2. If vacuum drops below supply vacuum found in programmer functional test, use long-nose pliers to pinch the two black hoses leading from side of rotary valve. If vacuum reading improves, check programmer hoses for leaks, then go to Test 2.
3. If reading does not improve, leak is in rotary valve.

TEST 2 VACUUM MOTOR AND CHECKING RELAY

1. Leave tester set as in Test 1 above. Programmer should go to full heat.
2. Disconnect vacuum dummy plug or car vacuum harness from programmer. Vacuum checking relay should hold vacuum motor in full heat. If mechanism moves, vacuum motor or checking relay is leaking. Apply raw vacuum to vacuum motor then pinch hose at motor to see if leak is in motor. A good motor holds position.

TEST 3 AMPLIFIER AND TRANSDUCER

1. Connect tester harness to system. Place manual-automatic switch in manual and temp dial calibration switch in off position.
2. Remove small transducer vacuum hose and connect tester vacuum gauge to hose. 11 in. hg. or more vac. should be present on small transducer supply hose. Delay in obtaining 11 in. hg. or more may be due to a plugged restrictor located in the small transducer hose. Re-install hose on transducer.
3. Remove large vacuum hose from transducer. Connect tester vacuum gage to large port on transducer.
4. By rotating the manual control, vacuum readings of 1 to 5 in. hg. in max. A/C and 5 to 22 in. hg. in max. heat should be obtainable. Any value from 2 to 17 in. hg. can be obtained by careful adjustment of the manual control if the amplifier-transducer is functional.

TEST 4 FEEDBACK POTENTIOMETER ADJUSTMENT

1. Using screwdriver, slip feedback pot shaft counter-clockwise with respect to gear. Programmer should move to full heat.
2. Place manual-automatic switch in manual position. rotate manual control to max. heat.
3. Move manual control to 175.
4. Slip feedback pot shaft slowly clockwise looking for signs of vacuum motor mechanism movement.
5. Check adjustment with manual control. Travel should start when 175 is reached as knob is turned counter-clockwise from max. heat.
6. If feedback pot cannot be adjusted, replace amplifier-transducer assembly.

BLOWER SWITCH BENCH TEST – (USING J-23713 BENCH TEST HARNESS)

1. Place voltmeter knob at 6.
2. With manual-automatic switch in manual, rotate manual control back and forth. Voltage should drop then increase in steps. Steps will be smaller than those seen in car.

PROGRAMMER MOVES BUT VACUUM OPERATED DOOR(S) MALFUNCTION

If one of the doors does not operate, malfunction could be caused by plugged or pinched harness or plugged valve on programmer. To check programmer valve, cut off sealed hose on dummy plug for circuit malfunctioning and connect the vacuum gauge to the plug. Plug the dummy plug on the programmer vacuum valve. Connect dummy hose to vacuum supply hose (port 2) in car vacuum harness. Monitor vacuum while operating programmer with manual control. When completed seal dummy plug hose with rivet. **Do not use a screw.** Refer to Shop Manual for proper vac valve operation.

TEMPERATURE DOOR CHECK AND ADJUSTMENT

A mis-adjusted temperature door link may not allow the programmer to travel fully to max. heat or to max. cold and could result in poor heating or poor cooling complaints. To check adjustment, attach tester electrical harness between programmer and car harness. Put manual-automatic switch in manual and control lever in aut. Put voltmeter knob in 6. Rotate manual control from max. heat to max. cold. High blower should be obtained in A/C and M_3 in max. heat with control lever in high. Recirc operation should be obtained at max. cold. A 3 minute delay on some cars with these conditions met. Temperature door adjustment is correct to readjust.

1. Start engine and put control lever in defrost.
2. Loosen screw on programmer shaft.
3. Place manual-automatic switch in manual. Manual control at max. heat programmer should go to full heat.
4. Move temperature door to full heat position by pushing door link away from programmer. The blower air hold door.
5. Tighten screw and re-check as above.

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3. Blower Control Circuit Problem Diagnosis

The components and electrical circuits that make up the blower control circuit are shown in Fig. 1-40. Blower control can be divided into two separate categories, blower turn-on and blower speed control. Blower turn-on is accomplished when a ground path is completed. Relay coil grounds are completed by (a) the heater turn-on switch which provides delay for heater water warm-up in winter operation, (b) the in-car switch which provides immediate turn-on in summer operation, or (c) manual override in the "Def" setting. Blower speed control is accomplished by circuit board lever connections in the "Off" and "Lo" positions, by selective use of the resistors on the blower circuit board in the "Economy", "Auto" and "Bi-Level" lever settings, or by a high blower override circuit in the "Hi" and "Def" lever positions. It should be noted that the system air doors are always positioned to allow delivery of air into the passenger compartment. Problem descriptions and probable causes are listed in the following diagnosis chart:

SYSTEM OPERATES ONLY AT LOW BLOWER

1. Electrical disconnect at "Auto" blower relay.
2. Malfunctioning "Auto" blower relay.
3. Back-out terminal or power connection at six-way connector (located near programmer), at programmer, or at control head. Trace "Auto" blower circuit using electrical wiring diagram, Fig. 1-40.
4. Open in "Auto" blower circuit wiring.

Refer to wiring diagram Fig. 1-40.

NO BLOWER OPERATION IN ANY LEVER SETTING

1. Electrical disconnect at blower motor or at radio capacitor in series with blower feed.
2. Blown or open 15 amp. A/C-heater fuse.
3. Stalled blower motor.
4. Open circuit in wiring harness to blower motor.
5. Disconnect at six-way connector (near programmer).

NO BLOWER IN OFF OR LO SETTINGS

1. Malfunction of wiper contacts on control head circuit board.
2. Open low speed resistor on programmer.
3. Open in blower circuit wiring. Refer to wiring diagram, Fig. 1-33.

OPERATES AT LOW BLOWER ONLY EXCEPT IN "HI" AND "DEF"

(NO BLOWER OPERATION IN "ECONOMY", "AUTO" OR "BI-LEVEL" SETTINGS)

1. Problem in programmer wiper contacts or board.
2. Back-out terminal or disconnect at programmer electrical connector.
3. Open in programmer internal wiring.

BLOWER OPERATION ONLY IN "HI" OR "DEF"

1. Electrical disconnect at programmer (system will also operate only at maximum A/C).

BLOWER SPEED VARIES IN "HI" AND "DEF"

1. Malfunction or board in control head circuit board switch.
2. Open in control head wiring harness.
3. Open in by-pass circuit in wiring harness (refer to electrical circuit diagram, Fig. 1-49).

BLOWER OPERATES WITH IGNITION OFF

1. Malfunctioning auto blower relay (closed contacts).

BACK TO INDEX

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BLOWER SPEEDS SKIPPED IN "ECONOMY" OR "AUTO" SETTING

1. Open resistor on programmer blower circuit board.

NO HEATER TURN-ON IN COLD WEATHER EXCEPT IN "OFF", "LO" AND "DEF"

1. Electrical disconnect at heater turn-on switch (located at front of R.H. cylinder head).
2. Heater turn-on switch inoperative (will not close). Check by grounding switch feed wire.
3. If problem persists, refer to electrical circuit diagrams for wiring discontinuity.

(NOTE: If problem does not occur in shop, it is probable that the system is turned on by the in-car sensor. Disconnect control head electrical connector to disarm the in-car switch. If the blower turns off (with the engine warmed up), ground the heater turn-on switch feed wire. If the blower now turns on (in low blower speed), the heater switch is probably malfunctioning.)

IMMEDIATE HEATER TURN-ON IN COLD WEATHER

1. Normal condition in "Off" and "Lo" control heat lever settings.
2. Malfunctioning (closed) heater turn-on switch (remove and check cold).
3. Malfunctioning (closed) in-car switch.
4. If problem persists, refer to electrical circuit diagram, and trace wiring continuity.

A/C DELAYED IN HOT WEATHER UNTIL ENGINE WARMS UP (UNLESS CONTROL LEVER IS IN "LO" OR "DEF"

1. Malfunctioning (open) in-car switch.
2. Open in control head wiring harness (in-car switch circuit).
3. If problem persists, check wiring continuity in the in-car switch circuit. Refer to the wiring diagram, Fig. 1-40.

BACK TO INDEX

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4. Auxiliary Vacuum Problem Diagnosis

Auxiliary vacuum functions are defined as those vacuum circuits in the automatic temperature control system which do not affect the temperature of discharge air. Specifically that would include all vacuum functions except the transducer, relay portion of the vacuum checking relay, and the programmer vacuum motor. Included in the theory section are diagrams of the following auxiliary circuits.

1. Upper mode door vacuum circuit.
2. Lower mode door vacuum circuit.
3. Defroster bleed vacuum circuit.
4. Defroster door vacuum circuit.
5. Recirc door vacuum circuit.
6. Heater water valve vacuum circuit.
7. Auxiliary vacuum circuit check valve.
8. Compressor electrical circuit.

Because of the relative simplicity of each of the auxiliary vacuum circuits, the best diagnostic aid will be a clear understanding of the type of problem or complaint which would result from a malfunction in any of the individual circuits. Once the problem has been isolated to a specific circuit diagnosis will generally consist of checking vacuum connections at one or two points. The following chart presents the types of problems most likely to be encountered in each of the auxiliary circuits. For more complex problems a procedure to completely qualify the vacuum system is presented in the last block of the diagnosis chart.

It should be noted that because of the inter-relationship of the vacuum circuits, a leak in one circuit may reduce the vacuum supply to another circuit sufficiently to cause a malfunction of the second circuit. For example, a water valve vacuum hose disconnected may prevent the mode doors from moving full travel causing a split mode condition.

UPPER AND LOWER MODE DOOR ACTUATION PROBLEMS

The most likely malfunctions would be "no air conditioner operation" and "split mode operation". Vacuum is required to get air conditioner mode. Check the hose connections at the mode door upper and lower vacuum actuators. Split modes may occur because of malfunctions in either the upper or lower door circuit, or because of leaks in other auxiliary vacuum circuits. It is recommended that the auxiliary vacuum circuit test procedure listed on the next page be used to isolate mode door vacuum problems.

DEFROSTER BLEED PROBLEMS

Actuation of the side (bleed) port of the defroster diaphragm is delayed by a porous delay plug inserted in the yellow-coded vacuum hose. Complaints relating to defroster bleed operation will generally be of two types:

1. No defroster bleed. Check hose connection at defroster bleed nipple of defroster vacuum actuator. If connections are satisfactory, porous plug is probably too restrictive. Replace plug. (Before installing new plug, check for vacuum in yellow line; and apply hose to nipple, without the plug, to check bleed door operation.)
2. Rapid fogging of windshield when heater turns on. Either there is no porous delay plug or installation of the plug is incorrect.

DEFROSTER DOOR ACTUATION PROBLEMS

The most common problem to be expected in this circuit would be "no air out of defroster outlets in "Def" setting". Vacuum to the defroster actuator is required for defroster operation.

1. Check hose connection (blue) at defroster actuator.
2. Check for vacuum at the control head purple hose.
3. If system stays in A/C mode at "Def", check vacuum circuit to determine why mode override did not occur.

If problem persists, see auxiliary vacuum circuit test on next page.

RECIRC AIR DOOR ACTUATION PROBLEMS

The most likely problem to be encountered will be "no recirc air in Hi or Auto lever settings". Vacuum is required to obtain recirc air. Check hose connection at recirc air door. Remove vacuum delay plug to check for adequate vacuum at "Hi" and "Auto" settings and 65° dial. If vacuum is available but door won't move with plug in circuit after approximately 3 minutes, replace plug.

BACK TO INDEX

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HEATER WATER VALVE CONTROL PROBLEMS

The water valve is a normally open valve requiring vacuum to close off water flow. It would be very difficult for a driver to recognize a problem in the water valve circuit by "no heater water shut-off"; however, a leak in that circuit may manifest itself by reduced vacuum levels available in other vacuum functions. The most likely such complaint would be a split mode delivery. Use the external vacuum circuit test presented below to isolate vacuum problems.

AUXILIARY VACUUM CIRCUIT CHECK VALVE PROBLEMS

The check valve for the auxiliary vacuum circuit is located in the programmer vacuum checking relay assembly. A malfunction of this check valve will probably result in complaints of loss of a specific function (such as "A/C shuts off") during accelerations or mountain driving. The check valve may be checked with the system operating by disconnecting and plugging the black hose feeding the programmer checking relay. The vacuum functions (a vacuum gage in the purple hose or the system in A/C mode) should hold. If they do not hold, reinstall the black hose, and pinch the purple hose. If the functions now hold, the check valve is bad. If the functions continue to leak down, there is a circuit leak further upstream. Use the auxiliary vacuum circuit test below to locate the leak.

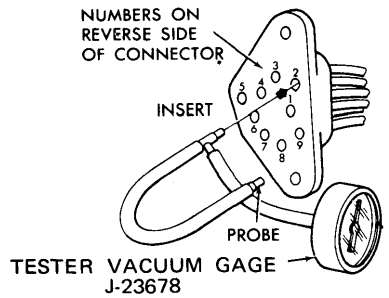
COMPRESSOR ELECTRICAL PROBLEMS

Malfunctions in the compressor electrical circuit would result in complaints of "no cooling", or "insufficient cooling". Perform the following checks:

1. Blown thermal fuse or disconnect at thermal fuse. Refer to Note 6.
2. Blown 15 amp fuse in fuse block.
3. Electrical disconnect at compressor clutch coil.
4. Electrical disconnect at compressor ambient switch.
5. Electrical disconnect at the three-wire electrical connector to compressor.
6. Backed-out terminal or disconnect at the control head electrical connector.
7. Malfunctioning compressor ambient switch.
8. Open in wiring harness. Refer to electrical circuit diagram, Fig. 1-49.

AUXILIARY VACUUM CIRCUIT TEST PROCEDURE

Remove car vacuum harness plug from programmer valve, which should direct all airflow to floor except for defroster bleed air. Connect tee with short hose and union to J-23678 tester vacuum gauge hose as shown in sketch at right, inserting tee in Port No. 2 of harness plug and probing each of the other ports in turn. Make sure that control head lever is set as specified for each step, and cover up probe on Ports 3 and 9 when called for, to seal off other circuit branches. For each step, full vacuum should be read after actuator-travel is completed.



Control Lever	Probe Port:	Hose Color	Cover Up	Other Hoses In Circuit	Action Expected
Bi-Level	None	Black	Probe	Yellow	Defroster door moves to "bleed" position
Bi-Level	1	White	None	None	Hot water valve closes - Check air in "max. heat"
Bi-Level	3	Red	Port 9	Purple, Tan	Lower mode door moves to A/C position
Bi-Level	4	Orange	None	None	Recirc. door opens - 1-2 min. delay
Lo	6	Chartreuse	Port 9	Purple	Checks control head vacuum leakage
Lo	6 or 8	Green	None	None	Upper mode door moves to A/C position
Hi	7	Dark Brown	None	Tan	Lower mode door moves to A/C position
Def	9	Purple	Port 3	Red, Dk. Blue	Defroster door moves to full "DEF" position

A low vacuum reading in any step indicates a leak in control head valve or in the hoses and components listed in that step. If some function is missing even though full vacuum is available, reconnect harness plug to programmer and check vacuum at extreme end of hoses involved, to distinguish between a pinched hose and a mechanical bind in actuator door.

BACK TO INDEX

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5. Refrigeration Problem Diagnosis

A properly-operating refrigeration system will maintain evaporator core cooling surfaces at 32°F. (0°C) when refrigeration is required, if engine speed is sufficient and the heat load on the system is not excessive. A refrigeration problem exists when there is malfunction in one of the refrigeration components or in the overall system which interferes with this function. In most cases, the problem will result in higher-than-normal core temperature and loss of effective cooling; in a few specific cases the core will operate at a temperature lower than 32°F. (0°C) and condensate in the core will freeze and block airflow, again causing a loss of cooling.

It is important to separate refrigeration problems from temperature control problems. This can be done simply during the control system function test.

1. Perform control system functional test described on Page 1-39.
2. If system operates properly, return lever to AUTO and set dial at 65°.
3. Install thermometer in right hand air conditioner outlet. Wait approximately one minute. Thermometer should read 40° to 50°F (5° to 10°C) unless temperature or humidity of test area is excessively high.
4. If the discharge temperature is significantly higher than 50°F (10°C), disconnect and short across ambient sensor electrical connector. Check to assure that the air-mix door link arm is pivoted fully to the "Max A/C" position.
5. If the discharge air temperature drops to 50° or below as a result of shorting the sensor, the problem belongs in the Temperature Control category.
6. If the temperature does not change and is still significantly higher than 50°F (10°C), a refrigeration problem exists.

Many refrigeration problems can be readily diagnosed without connecting the refrigeration gage set or performing the more extensive Cooling Capacity Performance Test. Malfunctions causing a problem of this sort are listed in the following chart:

NO REFRIGERATION OR INSUFFICIENT REFRIGERATION

Gage set usage not required for diagnosis.

1. No voltage to compressor clutch - check thermal fuse. Refer to Note 6.
   Check compressor electrical circuit, including compressor ambient switch and ground wire.
   Check 15 amp A/C-heater fuse.
2. Compressor seized – clutch plate slips.
   Clutch plate moves rearward and engages pulley but pulley cannot drive it.
3. Compressor belt slipping.

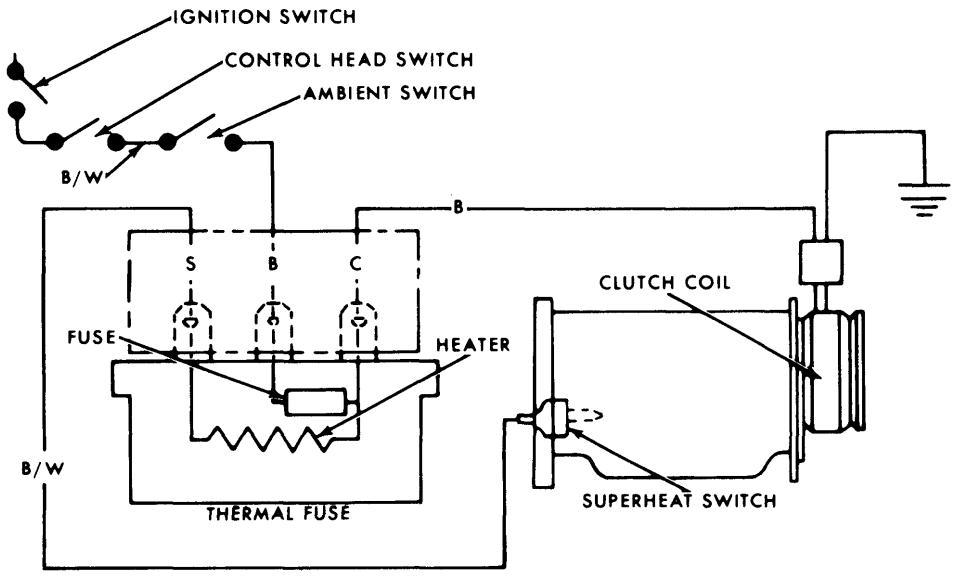


Fig. 1-41 Low Refrigerant Flow Detection System

BACK TO INDEX

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REFRIGERATION DIAGNOSIS CHART – EEVIR SYSTEM

Observe refrigeration system in areas listed below while engine operates at 2,000 RPM with control lever in "HI" and temperature dial at 65. All windows should be open and hood should be up. Blower motor should be disconnected when required in chart.

System Condition	OBSERVED OPERATING CONDITIONS						System Correction
	Outlet Air Temp.	Sight Glass	Head Pressure at Ambient Temperature	Evaporator Pressure	Evaporator Outlet Pipe Temperature	Oil Bleed Line Temperature	
Normal	40 - 50°	Clear	70° 80° 90° 100° 160# 190# 220# 250# 200# 230# 260# 290#	28-32 PSIG	Cold	Warm	
With Blower Lead Off	No Air Flow		Lower than Normal	Maintains Pressure		Gets Cold	
Refrigerant * Charge Low	Warm	Foamy or Bubbly †	Lower than Normal	Normal to Low	Warm	Cold	Find Leak. Repair and Recharge.
VIR Liquid * Pickup Tube Screen Partially Plugged	Warm	Foamy or Bubbly	Low	Normal to Low	Cool or Warm	Cool or Warm	Clean Screen and System as Required. Change Desiccant and Recharge.
Refrigerant * Charge Lost	Warm	Clear	Very Low	Very Low	Warm	Warm	Find Leak. Repair, Change Desiccant and Recharge.
Refrigerant Overcharge Blows Relief Valve on Hot Days	Normal	Clear	High	Normal	Cold	Warm	Recharge to the Specified Charge.
X-Valve * Diaphragm ** Discharged (Failed Closed)	Warm	Clear	Low	Low ***	Warm	Cold	Replace X-Valve Capsule.
Vacuum Loss * in STV †† Capsule Bellows or Valve Piston Stuck Closed	Warm	Foamy or Bubbly	Low	High	Warm	Warm	Replace STV Capsule.
STV * Stuck *** Open	Cold Evaporator May Ice Up Affecting Air Flow	Clear	Low	Normal to Low ***	Cold	Warm	Replace STV Capsule.
STV Setting too High	Warm	Clear	Normal	High	Cool to Warm	Cool or Warm	Replace STV Capsule.

* – Superheat Switch May Close and Thermal Fuse Link Open to Shut Off the Compressor.
** – Allow the System to Warm Up and Equalize Before Repeating the Test. If the Condition Doesn't Recur the System has Excess Moisture Causing Ice to Form in the Valve. Discharge the System, Replace the Bag of Desiccant, Evacuate the System for 30 Minutes and Recharge.
*** – Goes to Low Pressure or Vacuum with Blower Disconnected.
† – May be Bubbly or Clear with Blower Disconnected.
†† – System Will Not Accept Charge.

BACK TO INDEX

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Listed below are a number of problems which will cause a relatively minor loss of capacity (gage set required).

1. Excess bugs, leaves, etc. on condenser will cause higher-than-normal head pressure.
2. Excess oil or refrigerant in system.
3. Air in system –
   Will cause higher-than-normal head pressure.
   Will also cause internal corrosion of parts.

(NOTE: Let system stand inoperative overnight. With the same gage, check first the low side pressure and then the high side pressure. If the high side pressure is significantly higher than the low side pressure, there is probably air in the system. Purge, evacuate and recharge.)

The chart on page 1-52 lists problems that required connecting the gage set.

6. Low Refrigerant Flow Detection System Diagnosis

The thermal fuse, Fig. 1-42 and superheat switch is designed to protect the air conditioning compressor against damage when refrigerant flow to the compressor is inadequate due to low or lost charge or valve malfunction.

During normal operation, current flows through the control head switch, ambient switch and thermal fuse to the clutch coil to actuate the compressor clutch, Fig. 1-41. If a partial or total loss of refrigerant occurs in the

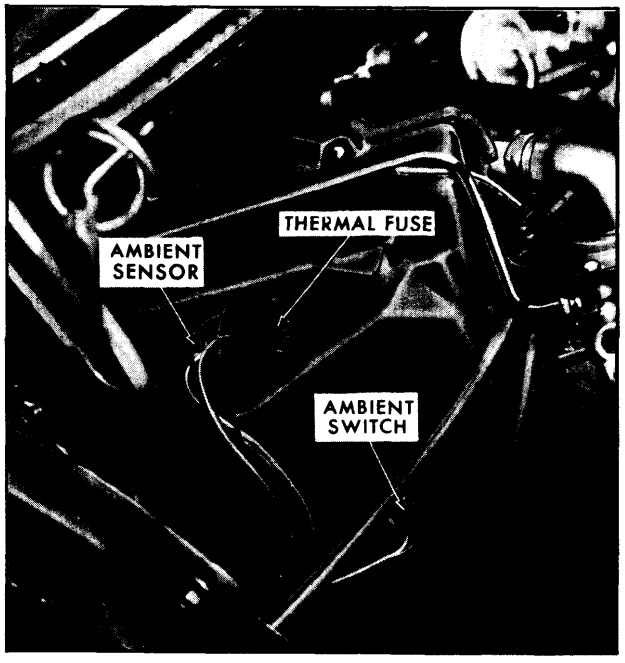


Fig. 1-42 Ambient Sensor and Switch

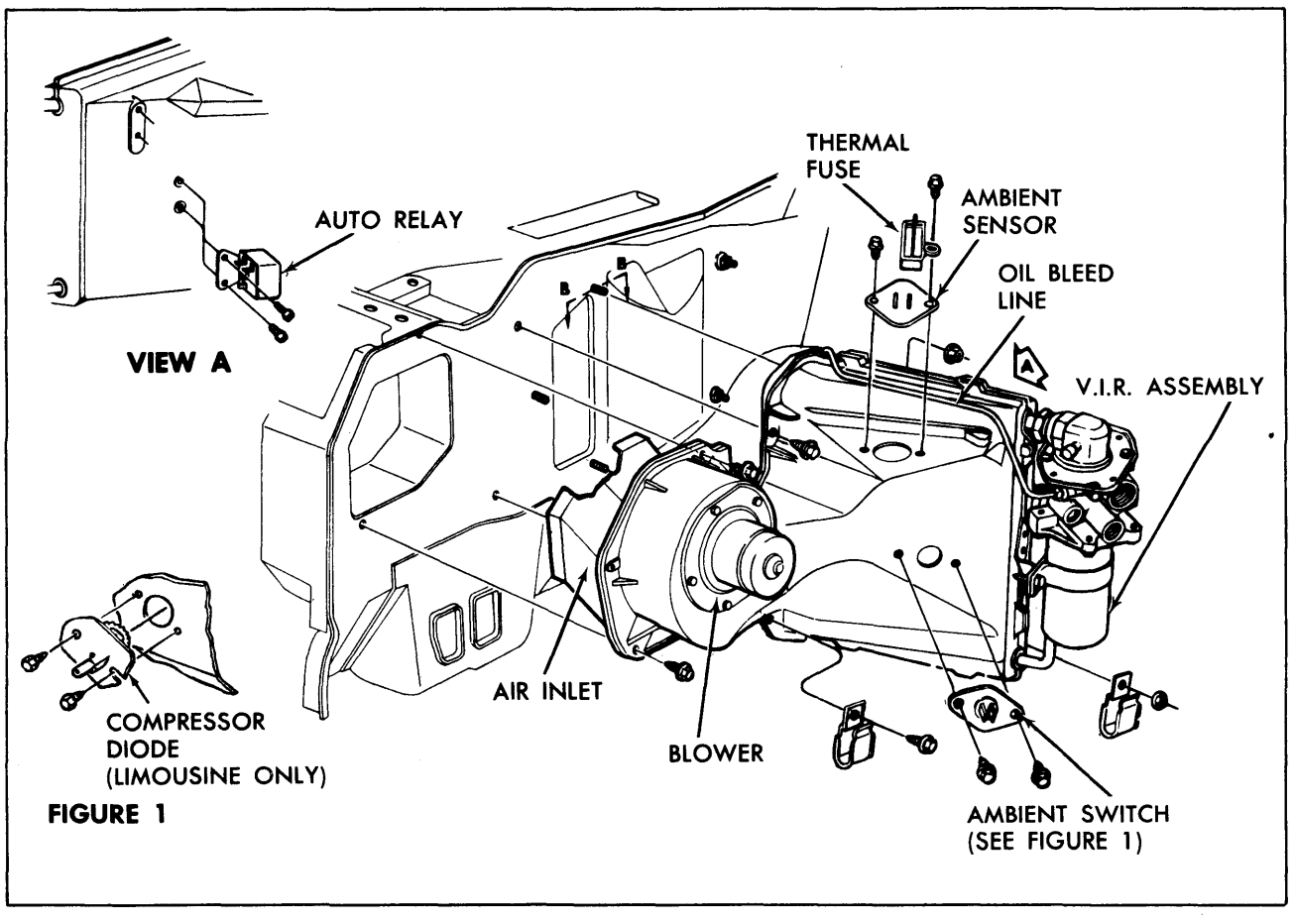


Fig. 1-43 Temperature Control Circuit

BACK TO INDEX

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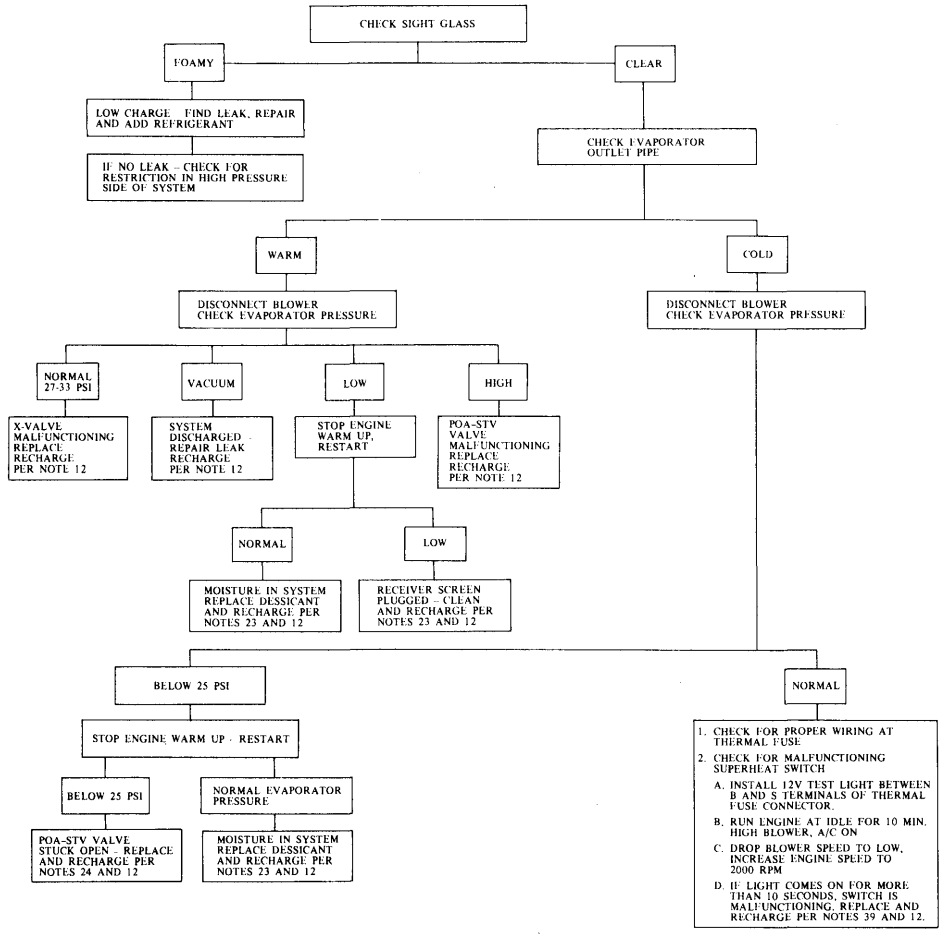
system, the contacts in the superheat switch close, as the switch senses low system pressure and high suction gas temperature. When the contacts close, current flows to energize a resistor-type heater in the thermal fuse, Fig. 1-41.

The resultant heat melts the fuse link and the circuit to the compressor clutch coil opens. Compressor operation ceases and damage due to low refrigerant flow is prevented. The superheat switch must be closed for approximately 2 minutes to blow the fuse.

Before thermal fuse replacement, the cause of refrigerant loss must be corrected.

DIAGNOSIS OF LOW REFRIGERANT FLOW DETECTION SYSTEM

Compressor will not operate if thermal fuse is blown. To check for blown fuse, remove harness connector and short between terminals "B" and "C" in the harness connector. If compressor now operates but did not before, thermal fuse is blown; proceed with Step 1. If compressor does not operate refer to compressor electrical problems on page 1-50.



7. A.T.C. Tester—J-23678

The A.T.C. Tester, J-23678, is designed for on-car diagnosis of control problems utilizing car electrical and vacuum supplies. The Tester will not only locate the problem area but will also isolate the individual malfunctioning component. Instructions (J-23678-50A) for the MKII programmer are furnished with the tester and reprinted on pages 1-45 and 1-46.

8. Blower Switch Bench Test (Using J-23713 Bench Test Harness)

The ATC Programmer Test Harness, J-23713, is a substitute blower motor resistor that is used with ATC Tester, J-23678, an Adapter Harness, a vacuum supply and a 12-volt source to bench-test the programmer, Fig. 1-44.

(NOTE: An adapter harness must be fabricated to convert tester connector to the Mk II programmer connector.)

1. With ATC Programmer on bench, plug harness of ATC Tester, J-23678, into appropriate end of Adapter harness.
2. Connect opposite end of Adapter Harness to programmer connector.
3. Plug substitute blower resistor, J-23713, into female plug of harness on Tester, J-23678. (Not as shown)
4. Connect positive and negative leads of J-23713 Harness to a voltage source.
5. Connect dummy vacuum plug provided with J-23678 into vacuum source.
6. Place voltmeter knob of J-23678 at 6 and place manual-automatic switch in manual position.

BACK TO INDEX

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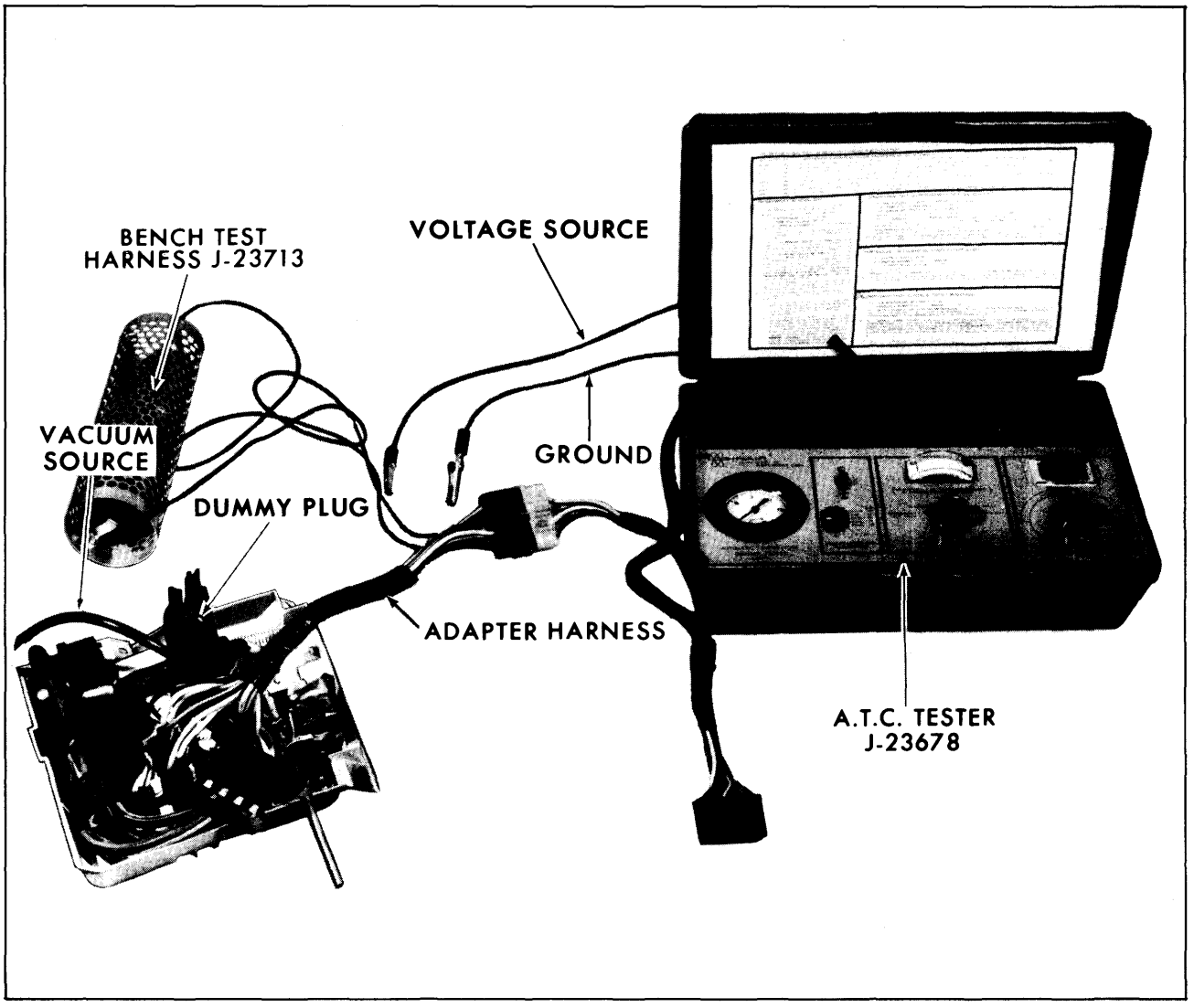


Fig. 1-44 Bench Testing Programmer

7. Rotate manual control knob back and forth (from max. cold to max. A/C). Voltage should drop, then increase, in steps. Voltage variation will be less than when performed on car.

SERVICE INFORMATION

STANDARD SERVICE PROCEDURES

9. Handling Refrigerant and Refrigeration Components

a. Maintaining Chemical Stability

The efficient operation of the air conditioning system is dependent on the pressure-temperature relationship of pure refrigerant 12. As long as the system contains pure refrigerant 12 (plus a certain amount of refrigeration oil which mixes with the refrigerant), it is considered to be chemically stable.

When foreign materials, such as dirt, air or moisture are allowed to get into the system, they will change the pressure-temperature relationship of the refrigerant. The system will no longer operate at the proper pressures and temperatures, and the efficiency of the system will decrease.

The following general practices should be observed to insure chemical stability in the system:

1. Whenever it becomes necessary to disconnect a refrigerant connection, wipe away any dirt or oil at or near the connection to eliminate the possibility of dirt entering the system. Both sides of the connection should be immediately capped or plugged to prevent the entrance of dirt, moisture, or foreign material. All air contains moisture. Air that enters any part of the system will carry moisture with it and the exposed surfaces will collect the moisture quickly.

2. Tools should be kept clean and dry. This includes the Charging Station and the Gage Set.

3. When adding oil, the container and the transfer tube through which the oil will flow should be exceptionally clean and dry in order to keep the refrigeration

BACK TO INDEX

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oil as moisture-free as possible. For this reason, the oil container should not be opened until ready for use, and should be capped immediately after use.

4. When it is necessary to open a system, have everything needed ready and handy so that as little time as possible will be required to perform the operation. Do not leave the system open any longer than is necessary.

5. Any time the system has been opened and sealed again, it must be properly evacuated, as described in Note 12.

CAUTION: Use only refrigerant from a reputable dealer, as contaminated refrigerant will not only lower the efficiency of the system, but may damage the unit. Use only refrigerant 12 for the Cadillac system, since any other refrigerant may damage the compressor or other parts by incorrect pressure-temperature relationship.

b. Precautions in Handling Refrigerant

Refrigerant 12 is stored and shipped as a liquid under pressure (in metal containers of various sizes and weights).

WARNING: IN HANDLING REFRIGERANT DRUMS, ALWAYS OBSERVE THE FOLLOWING SAFETY PRECAUTIONS:

1. DO NOT LEAVE DRUM UPCAPPED IF DRUM IS SO EQUIPPED. THE METAL CAP FURNISHED WITH THE DRUM WHEN IT IS SHIPPED IS TO PROTECT THE VALVE IN CASE THE DRUM IS ACCIDENTALLY KNOCKED OVER. THIS ELIMINATES THE POSSIBLITY OF THE DRUM FLYING THROUGH THE SHOP AND CAUSING SERIOUS DAMAGE TO PEOPLE AND PROPERTY. A SAFETY PLUG IS PROVIDED ON THE VALVE IN CASE THE TEMPERATURE EXCEEDS THE SAFE LIMITS OF THE DRUM. THE CAP IS DESIGNED SO THAT IF THE SAFETY PLUG AT THE VALVE SHOULD BLOW, THE REFRIGERANT WILL ESCAPE WITHOUT CAUSING THE DRUM TO MOVE.

2. DO NOT OVERFILL DRUM. A SAFETY PLUG IS PROVIDED IN CASE THE TEMPERATURE OF THE REFRIGERANT EXCEEDS THE SAFE LIMITS OF THE DRUM. HOWEVER, IF THE DRUM IS OVERFILLED, THE PRESSURE CREATED COULD CAUSE THE DRUM TO EXPLODE BEFORE THE TEMPERATURE RISES TO THE POINT WHERE THE SAFETY PLUG WOULD BURST AND ALLOW THE REFRIGERANT TO ESCAPE.

3. DO NOT CARRY THE DRUM IN THE PASSENGER COMPARTMENT OF A CAR. ALWAYS PLACE DRUM IN THE LUGGAGE COMPARTMENT OF CAR. IF A DRUM IS CARRIED IN AN OPEN TRUCK SHIELD IT FOR PROTECTION FROM THE SUN'S RAYS. THIS HEAT COULD INCREASE THE PRESSURE ENOUGH TO CAUSE SAFETY PLUG TO BURST.

4. DO NOT SUBJECT DRUM TO HIGH TEMPERATURE WHEN CHARGING SYSTEM – USE WATER NO WARMER THAN 125°F TO HEAT DRUM. NEVER PLACE DRUM ON STEAM RADIATOR OR STOVE, OR USE TORCHES FOR HEATING DURING CHARGING.

5. DO NOT DISCHARGE REFRIGERANT 12 INTO AREAS WHERE THERE IS AN EXPOSED FLAME OR WHERE IT COULD BE DRAWN INTO THE ENGINE AIR INTAKE WHEN THE ENGINE IS OPERATING. CONCENTRATIONS OF THIS GAS IN CONTACT WITH A FLAME MAY PRODUCE A POISONOUS GAS.

6. ALWAYS WEAR GOGGLES WHEN DOING WORK THAT INVOLVES OPENING THE REFRIGERANT LINES. AN ACCIDENT CAN EASILY CAUSE LIQUID REFRIGERANT TO STRIKE THE FACE. IF GOGGLES PROTECT THE EYES, THE LIKELIHOOD OF SERIOUS INJURY WILL BE REDUCED. SHOULD THE LIQUIFIED REFRIGERANT COME IN CONTACT WITH THE EYES, THE PERSON SUFFERING THE INJURY SHOULD IMMEDIATELY HAVE THE EYES RINSED WITH A GREAT AMOUNT OF COOL, CLEAN, WATER. AVOID RUBBING OR FURTHER IRRITATION OF THE EYES. THE PERSON SHOULD THEN BE TAKEN TO A QUALIFIED PHYSICIAN FOR EVALUATION.

FOR TREATMENT TO "FROST BITTEN" OR "FROZEN" SKIN DUE TO CONTACT WITH LIQUID REFRIGERANT, PROCEED AS FOLLOWS:

a. RAPID REWARMING OF AFFECTED AREAS BY MOIST HEAT. IMMERSE THE PART OR PARTS IN WATER AND MAINTAIN THE WATER TEMPERATURE BETWEEN 88°F. TO 100°F.

b. AFTER REWARMING PROCESS THE EXPOSURE OF THE PART TO ROOM AIR TEMPERATURE IS PERMISSABLE:

c. THE PERSON CAN THEN BE TAKEN TO A QUALIFIED PHYSICIAN FOR FURTHER EVALUATION.

d. TWO IMPORTANT THINGS TO REMEMBER:

1. DO NOT RUB OR COMPRESS THE AFFECTED PART WITH ICE, SNOW OR COLD WATER. MASSAGE OR FRICTION OF ANY TYPE IS HARMFUL TO FROZEN TISSUE.

2. DO NOT APPLY PRESSURE DRESSINGS OR OINTMENTS OF ANY TYPE.

c. Welding

Excessive heat applied to any section of the refrigerant lines will create excessively high pressures. For this reason, welding should not be performed on any portion of the car adjacent to the refrigerant units or lines.

BACK TO INDEX

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d. Undercoating

To simplify service operations, undercoating should not be applied to any connections or rubber lines of the refrigeration system. While it is permissible to undercoat the metal refrigerant lines, all flare joints and connections should first be masked.

e. Collision Service

It is very important that the air conditioning system be inspected as soon as possible whenever a car so equipped has been involved in a collision. If the system has been opened as the result of a collision, it will permit the entry of air, moisture, and dirt that will cause internal damage. As the length of time the system has been open and the extent of damage to the components will govern the replacement of parts and the service operations required, a definite procedure cannot be recommended to cover all cases. The following, however, may be used as a guide:

1. Make certain clutch is disengaged, if car is to be operated before repairs are made.
2. Inspect all units and lines, noting any damage.

a. If condenser is damaged it should be replaced. No repairs such as soldering, brazing or welding should be attempted.

b. Replace desiccant bag if system was open for any period of time (See Note 23).

3. Check compressor and clutch pulley for cracks. If compressor does not show evidence of external damage, it may be used.

f. Handling Components

1. Lines should be kept sealed and dehydrated in stock. Do not remove shipping caps from lines until just before installation.
2. Always use two wrenches when tightening fittings to prevent twisting the hoses or soft aluminum tubing. Lubricate all fittings with refrigeration oil to allow the joint to be tightened without twisting the pipe.
3. Cap ends of lines that have been disconnected for any reason, to prevent entrance of moisture or dirt.
4. Gage set and lines should be kept clean and free from moisture.
5. Do not leave refrigeration oil container open any longer than necessary, as the special oil is moisture-free, but will rapidly absorb moisture from the air.
6. Use Vacuum Pump, J-5428, or Charging Station, J-23500, to remove any air or moisture that may have entered the system when it was opened to replace a part.

g. Replacing Components

When removing any components or lines from the system, they must be capped and plugged immediately to prevent exposing them to moisture.

All components of the air conditioning system are shipped dehydrated and sealed. They are to remain sealed until just prior to making connections and should be at room temperature before uncapping to prevent condensation of moisture from the air that enters the components. They should not be uncapped any longer than necessary to make a connection.

All precautions should be taken to prevent damage to the fitting and connections. Any fittings with grease or dirt on them should be cleaned prior to assembly, using a clean cloth dipped in alcohol. If dirt, grease or moisture gets inside lines and cannot be removed, lines must be replaced.

All blue O-rings for making closures for shipment should be discarded and new black O-rings used for making final refrigerant connections.

Use a small amount of refrigerant oil on all tubes and hose joints and lubricate the O-rings with this oil before assembly. Always slip the lubricated O-ring onto the flange tube to insure proper locating and sealing.

All O-ring connections should be tightened with a torque wrench and a crowfoot wrench (used at a 90° angle to the torque wrench for accurate reading), in accordance with the table on Page 1-63. Note that the torque specified for aluminum tubing is less than that specified for steel tubing.

If a connection is made with steel to aluminum, use torques for aluminum. In other words, use the lower torque specification. Use steel torques only when both ends of connection are steel.

Backing wrenches of the required size must be used during the final tightening of all O-ring and flare-type connections.

Pre-formed refrigeration system lines are not serviced; however, bulk tubing is available along with a selection of fittings so that a replacement hose may be assembled. Drawings (such as Fig. 1-45) are included several places in this service manual showing the routing and attachment of these lines. When assembling refrigerant lines extreme care is required to prevent dirt, rubber chips, etc. from entering the system. A short blast of refrigerant is recommended to clear the hose of contamination. Hoses may be lubricated with refrigeration oil to aid in assembly.

10. Maintenance and Inspection

The following items should be checked every spring and fall and whenever the car is brought in to check the air conditioning.

a. Functional Test of the Air Conditioning

See Note 14 to perform the test.

b. Sight Glass Check

Check EEVIR sight glass for full charge of refrigerant. If system is low, leak test and make necessary repairs. See Note 11.

(NOTE: It is normal for some foaming to occur in the sight glass with an outside air temperature of 70°F. or below.)

c. Leaks

If there is evidence of oil leaks, leak test entire system and make necessary repairs. See Note 13.

d. Coolant Level

Check coolant for proper level as described in Section 6, Note 4.

BACK TO INDEX

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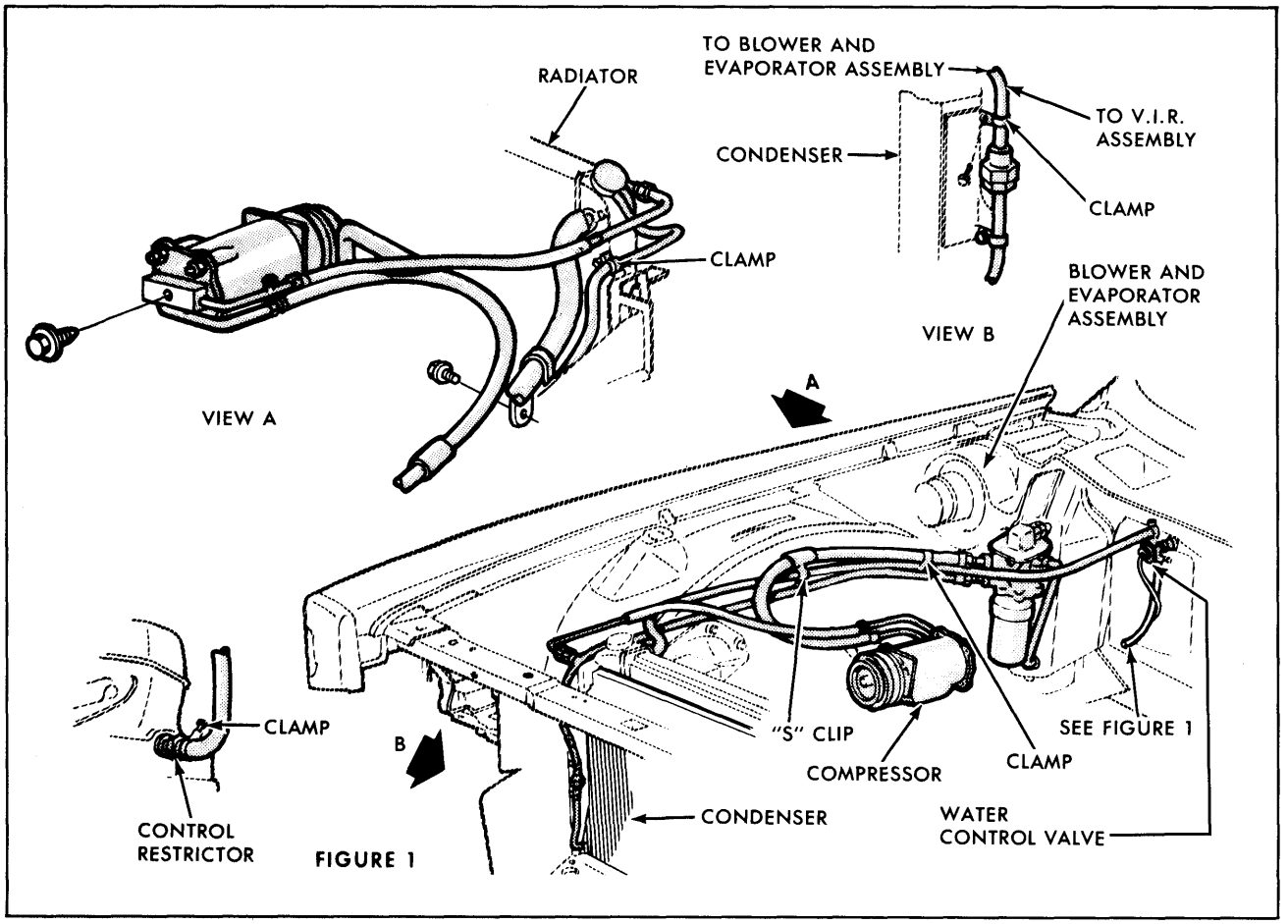


Fig. 1-45 Refrigerant Hose Routing

e. Belt Tension

Check tension of belts as described in Section 6, Note 10.

f. Compressor Clutch

Observe clutch to make certain it is engaging and disengaging while moving the selector lever between ECONOMY and LO with the engine idling.

11. Checking Refrigerant Charge

Bubbles in the sight glass do not always indicate that the system is low on refrigerant. If the system is at a control point, bubbles may appear in the sight glass even though the system is fully charged.

A certain amount of foaming is also normal with an outside air temperature of 70°F. or below.

Check refrigerant charge at the sight glass and proceed as described below to make certain that system is not at bubble producing control point.

1. Connect Charging Station low pressure line to gage fitting on EEVIR connector shell, Fig. 1-46. Adapter J-24598 is required to adapt the high pressure fitting to the charging station.

2. Move Automatic Climate Control lever to AUTO position and set temperature dial to 65°F.

3. Run engine at 1500 rpm for 5 to 7 minutes to stabilize system.

4. Observe low pressure reading. Low pressure gage should read approximately 29.5 ± .5 pounds.

5. Slow engine to 600 RPM.

6. Maintain engine speed at this level, wait several minutes and then observe sight glass in EEVIR assembly.

a. If a solid column of refrigerant appears in sight glass, it is an indication that charge in system is adequate or overcharged.

b. If bubbles appear in sight glass, it is an indication that system is low on refrigerant. Add refrigerant to system as described in Note 12.

12. Purging, Evacuating and Charging the Refrigeration System

a. Purging Refrigerant From System

When replacing any air conditioner component, the system must be purged (drained) of refrigerant. The purpose is to lower pressure inside the system so that a component part can be safely removed. Following is a simplified procedure for purging refrigerant from system.

WARNING: ALWAYS WEAR GOGGLES FOR EYE PROTECTION WHEN DOING WORK THAT INVOLVES OPENING THE REFRIGERATION SYSTEM.

BACK TO INDEX

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1. Remove caps from pressure fittings on high pressure line and on EEVIR connector shell.
2. Install a length of 5/16" diameter clear plastic hose over the threaded end of adapter, J-25498 (J-5420 on early cars). Secure with a clamp.
3. Install hose from J-25498 into a graduated container such as an empty refrigerant oil bottle.
4. Loosely install Gage Adapter, J-25498, on high side pressure fitting.
5. Tighten gage adapter and allow system to discharge at a rapid rate into the container.

(NOTE: Rapid discharge will cause oil loss; container is necessary to collect oil.)

6. Measure oil collected in container and discard old oil.
7. New refrigeration oil should be added to a replaced component as described in Part F of this note. If this method is not practical, oil lost during rapid discharge must be replaced as follows:

a. Connect charging station low pressure line to fitting on EEVIR connector shell.
b. Connect J-25498 to high pressure fitting.
c. Place hose from J-25498 into a container of fresh refrigeration oil.

(NOTE: Container should have more oil than was drained from system to prevent trying to draw all oil from bottle into system.)

CAUTION: Care should be exercised during this operation to ensure that no dirt is drawn into the system. Dirt may damage system components.

d. Start vacuum pump and draw into system as much oil as was lost during rapid discharge. Remove hose from container when this point is reached.

e. Elevate hose to allow oil in hose to be drawn into system.

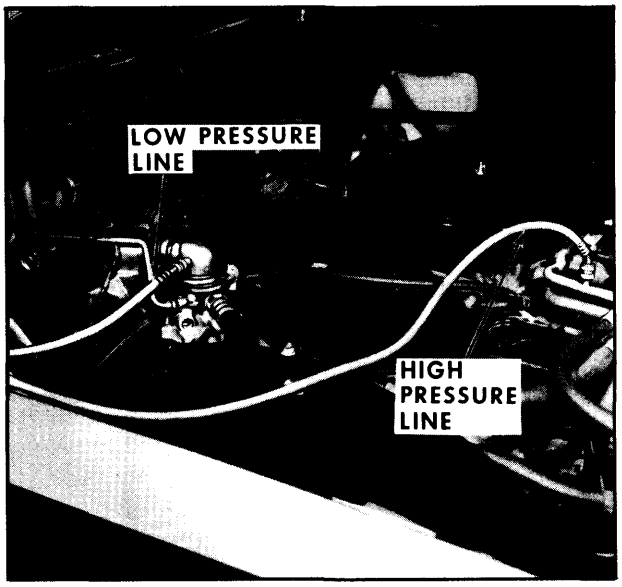


Fig. 1-46 Connecting Charging Station Hoses

f. Remove J-25498 and proceed with normal evacuation and charging (Parts c and d of this note).

b. Connecting Charging Station, J-23500

1. Remove caps from high pressure fitting on high pressure line and the gage fitting on EEVIR connector shell.
2. Make certain that all valves on charging station are closed.
3. Install Gage Adapter, J-5420, on Charging Station low pressure line and Adapter J-25498 to high pressure line (J-5420 on early cars).
4. Connect charging station high pressure line to fitting on high pressure line and low pressure line to gage fitting on EEVIR connector shell, Fig. 1-46.

c. Evacuating System

Whenever the air conditioning system is opened for any reason, it should not be put into operation again until it has been evacuated several times. For this operation use Charging Station, J-23500, to remove air and moisture that may have entered the system.

1. Purge system as described in part a of this note.
2. Connect Charging Station high and low pressure lines as described in part b of this note.
3. Plug in Charging Station to 110 volt outlet and turn on vacuum pump switch.
4. Open valve 1 (low pressure control), valve 2 (high pressure control), and valve 3 (vacuum control).
5. Operate to obtain 28 inches of vacuum, then continue to operate pump for ten minutes.

(NOTE: In all evacuating procedures specification of 28-29" of vacuum is used. This evacuation can only be attained at or near sea level. For each 1000 feet above sea level where this operation is being performed, specification should be lowered by one inch of mercury vacmum. At 5000 feet elevation only 23" to 24" of vacuum can normally be obtained.)

6. While evacuating the system, add refrigerant to cylinder on Charging Station by opening valves on refrigerant drum and at bottom of cylinder (valve 4 must be closed). Open valve on top of cylinder until proper liquid level is obtained in sight tube, and then close both top and bottom valves on cylinder.
7. Close valves 1, 2 and 3 and turn off vacuum pump switch. System should hold vacuum, unless there is a leak.
8. Slowly open valves 2 and 4, allowing 1/2 to 1 lbs. of refrigerant to enter system, then close valves.

(NOTE: It is advisable at this time to leak test system for major leaks as described in Note 13.)

9. Purge system.
10. Repeat steps 4 and 5.
11. Repeat step 7.
12. System is now ready for complete charge of refrigerant.

d. Adding Refrigerant (Complete Charge)

1. Connect heating element plug to a 110 volt outlet.

BACK TO INDEX

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2. Disconnect refrigerant detection system at thermal limiter fuse and install jumper wire between "B" and "C" terminals of wiring harness.

3. Evacuate system as described in part c of this note. The system must be properly evacuated.

4. Fill cylinder on Charging Station with refrigerant as follows:

a. Open valves on refrigerant drum and bottom of cylinder (valve 4 must be closed).

b. Open valve on top of cylinder until proper liquid level (3-3/4 pounds on all except 75 Series. 5 pounds on 75 Series.) is obtained in sight tube.

5. Fully open valves 2 and 4 to allow refrigerant to flow into system.

(NOTE: If refrigerant does not flow freely into system, it is probably due to valve cores in high pressure line and EEVIR fittings not being depressed far enough. If this condition exists, try another Gage Adapter, J-5420 or J-25498 or build up adapter depressor tongue with solder to depress valve core further.)

6. After liquid refrigerant has stopped flowing into high pressure side of system, close valve 2.

7. Start engine and run at approximately 1500 rpm with transmission in PARK position.

8. Move Automatic Climate Control lever to AUTOMATIC position and set temperature dial to 65°F.

9. Open valve 1 (valve 4 must also be open). This will allow refrigerant remaining in cylinder to be pulled into system.

10. Shut off engine, close all valves, disconnect Charging Station high and low pressure lines and replace caps on fittings.

11. Remove jumper wire and reconnect thermal limiter fuse.

12. The system should never be overcharged because excessive head pressures result.

e. Adding Refrigerant (Partial Charge)

Refrigerant can be added to the air conditioning system using Charging Station, J-23500. The charging lines must be purged before any refrigerant is added.

1. Connect Charging Station as described in part b of this note.

(NOTE: Purge air from Charging Station high and low pressure lines before connecting. To purge lines, crack open valves 1, 2 and 4, making certain that there is some refrigerant in cylinder, then install lines and close valves.)

2. Disconnect refrigerant flow detection system at thermal limiter fuse and install jumper wire between "B" and "C" terminals of wiring harness.

3. Operate engine at 600 rpm with transmission in PARK position.

4. Move Automatic Climate Control lever to AUTO position and set temperature dial to 65°F.

5. Fill cylinder on Charging Station with 2 to 3 pounds of refrigerant, as follows:

a. Open valves on refrigerant drum and bottom of cylinder (valve 4 must be closed).

b. Open valve on top of cylinder until proper liquid level is obtained in sight tube.

c. Close valve at bottom of cylinder.

6. Open valves 1 and 4. Watch sight glass until solid column of liquid appears, then close valves.

(NOTE: It is normal for some foaming to occur in sight glass with outside air temperature at 70°F or below. See Note)

7. After five minutes of operation, check sight glass again. If no bubbles appear, open valves 1 and 4 and add another 1-1/4 pounds of refrigerant.

(NOTE: The VIR sight glass will clear at approximately 2-1/2 pounds charge – or at 1-1/4 pounds less than full charge.)

8. Shut off engine, close all valves, disconnect Charging Station, and install gage fitting caps.

9. Remove jumper wire and reconnect thermal limiter fuse.

10. The system should not be overcharged due to excessive head pressures that result.

f. Adding Oil

The six-cylinder compressor uses 525 viscosity refrigeration oil. An oil charge of 10-1/2 fluid ounces is required.

It is important that only the specified type and quantity of oil be used in the compressor. If there is a surplus of oil in the system, too much oil will circulate with the refrigerant, causing the cooling capacity of the system to be reduced. Too little oil will result in poor lubrication of the compressor.

When it is necessary to replace a component of the refrigeration system or when the system is discharged at a rapid rate as described in part a of this note, certain procedures must be followed to assure that the total oil charge in the system is correct when the system is reactivated. When the compressor is operated, oil gradually leaves the compressor and is circulated through the system with the refrigerant. Eventually a balanced condition is reached in which a certain amount of oil is retained in the compressor and a certain amount is continually circulated. When the system is discharged at a rapid rate or a component of the system is removed after the system has been operated, some oil will go with it. To maintain the original total oil charge, it is necessary to compensate for this by adding oil to the new replacement part.

The procedures for adding oil are as follows:

1. Compressor Only

1. Idle engine for 10 minutes at 1000 – 1500 rpm at maximum cooling and high blower speed to allow oil to distribute itself in system in a normal manner.

2. Remove compressor from car and place it in a horizontal position with drain plug downward. Drain oil, measure, and discard it.

3. Drain oil from compressor that is to be installed in car.

BACK TO INDEX

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4. If oil drained in step 2 is more than 4 fluid ounces, add to the new compressor the same amount of oil as drained from replaced unit plus the amount lost during rapid discharge.

5. If the oil drained in step 2 is less than 4 fluid ounces, add 6 ounces of oil to new compressor, plus the amount lost during rapid discharge.

2. Replacing Components

Whenever replacing a component of the air conditioning system, measured quantities of 525 viscosity refrigeration oil should be added to the component to assure that total oil charge in system is correct before unit is operated.

Oil should be added to replacement components as indicated below.

Evaporator (front or rear)	Add 3 fluid ozs.*
Condenser	Add 1 fluid oz.*
EEVIR	Add 1 fluid oz.*
"*Plus the amount lost during rapid discharge.	

Oil should be poured directly into the replacement component. If an evaporator is installed, pour oil into inlet pipe with pipe held vertically so oil will drain into core.

If any other components, such as valves or hoses are replaced, no additional oil is necessary.

3. Compressor and Components

CAUTION: If system has been operated and there is evidence of a major loss of oil, system has probably lost all or most of its refrigerant. If any refrigerant remains, discharge it from system. Do not operate compressor any more than is absolutely necessary to avoid damage from lack of oil.

1. Remove compressor and place in a horizontal position with drain plug downward. Drain oil from compressor, measure it and then discard it. To promote draining, have suction connector open and tilt compressor as required.

2. Replace damaged component from which the oil was lost.

3. If more than 4 fluid ounces of oil was drained from compressor in step 1, add same amount of new oil to compressor, plus an amount to compensate for that in damaged component, as shown in the table.

4. If less than 4 fluid ounces of oil was drained from compressor in step 1, add 6 fluid ounces of oil, plus amount shown in the table for component being replaced.

13. Leak Testing Refrigeration System

There are two methods that may be used for detecting leaks in the air conditioning system; a leak detector fluid or an electronic leak detector.

a. Leak Detector Fluid

Leak detector fluid (mixed with water per directions on bottle) may be used by daubing or squirting the liquid around joints to be tested. Ordinary leaks will form a cluster of bubbles almost immediately. Extremely small leaks will form a white foam which will materialize with a time limit from a few seconds to a minute, depending on size of leak.

In order to locate leaks with this fluid, it is essential that you see all of the surfaces you are checking with a good light; otherwise small leaks could easily be overlooked.

b. Electronic Leak Detector

Two types of electronic leak detectors are recommended: the more recently available Refrigerant Gun, J-23400; and Electronic Leak Detector, J-22235. Instructions for their use are included with the equipment.

14. Control System Functional Test

The following procedure is used to assure correct functional operation and requires approximately two minutes to perform. The system is to be tested at room temperature with the hood down, the doors and windows closed and the engine operating. Engine coolant must be warm. Proceed as follows:

1. Operate car at 1000 RPM or better.
2. Place A/C outlets in wide-open position.
3. Install thermometer in center A/C outlet.
4. Set control lever at "DEF" and temperature dial at 85°.
   a. Air should be delivered out of the defroster outlets.
   b. Blower should operate at high speed.
   c. Some air should come out heater outlet.
5. Set lever at "BI-LEVEL" and temperature dial at 75°.
   a. Air should be delivered from both the A/C and heater outlets.
   b. Blower should operate at a lower speed.
   c. Small airflow should come from defroster outlets.
6. Set lever at "HI" and temperature dial at 65°.
   a. Cool to cold air should be delivered from A/C outlets.
   b. Blower should operate at high speed.
   c. Recirc air door should open (will be slightly noisy).
7. Set lever at "AUTO" and temperature dial at 65°. After 45 seconds, discharge air temperature should be 50°F (10°C) or lower may be slightly higher in 90°F (32°C) or above ambient).
8. Set lever at "AUTO" and temperature dial at 85°.
   a. Blower speeds should drop (Hi - M_3 - M_2 - M_1 - etc.)
   b. Recirc door should close – noise level will drop.

BACK TO INDEX

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c. Discharge air temperature should increase.

d. Air delivery may change from A/C outlets to bi-level to heater outlet - depending upon ambient temperature.

9. Set lever at "LO" and temperature dial at 85°. Air should be delivered at fixed low blower.

10. Set lever at "ECONOMY" and temperature dial at 65°.

a. Air discharge should be from A/C outlets heater outlet or both (bi-level) depending on ambient temperature.

b. Blower speed may vary as in "AUTO".

c. A/C compressor should not operate.

11. Set lever at "OFF" and temperature dial at 65°.

a. Air discharge should be from heater outlet.

b. Blower should operate at fixed Lo speed.

c. A/C compressor should not operate.

15. Component Adjustments

Be sure to allow sufficient time for the car engine to "warm up" and for the system to "turn-on" before attempting calibration. Do not skip any steps in the Calibration Procedure.

a. Temperature Dial Calibration

1. Disconnect electrical connector from programmer and connect appropriate end of harness adapter J-24774 to the programmer and car harness.

2. Connect the ATC Tester J-23678 into the opposite end of Adapter Harness J-24774.

3. Working through opening in top of glove compartment, disconnect in-car sensor electrical connector and connect harness to double connector (black wires) coming out of Adapter Harness J-24774.

4. Place the "MANUAL-AUTOMATIC" switch on the tester in the "MANUAL" position.

5. Place the "TEMPERATURE DIAL CALIBRATOR" switch on the tester in the "CALIBRATE" position.

6. Note the voltmeter reading.

7. Press the "CALIBRATE" button and note the voltmeter reading.

8. With the "CALIBRATE" button pressed in, rotate the temperature dial on the control head until the voltmeter reading is the same as it was in Step 5 (when the button is not pressed in).

9. The temperature dial should be set at 75°. If it is not, use tool #J-21530 to hold the gear on the top of the temperature dial and slip the temperature dial to the correct setting, Fig. 1-47. If the temperature dial cannot be calibrated using this procedure, it is malfunctioning.

10. Remove test equipment and make all normal connections. Make sure in-car sensor aspirator hose is properly attached.

b. Mix Door Link Adjustment

1. Loosen the hex screw of the door link at the output shaft of the programmer, Fig. 1-48.

2. Place the control head selector lever in the "DEF" position.

3. Remove the electrical connector from the ambient sensor. This results in the proper position of the output shaft of the programmer (full heat position).

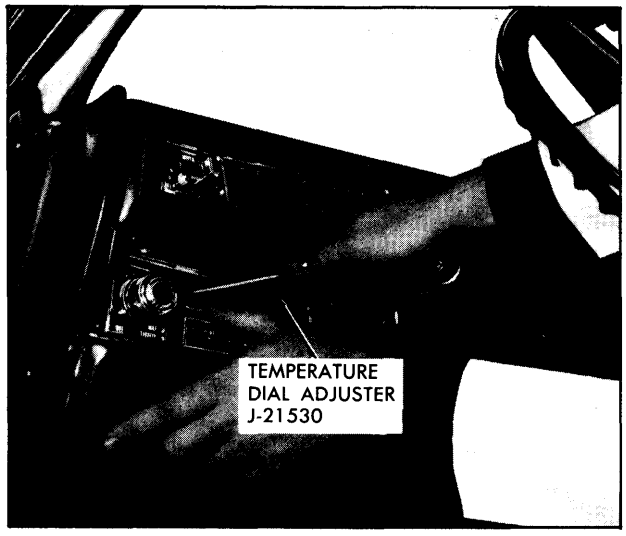


Fig. 1-47 Adjusting Temperature Dial

4. Check to make sure that the air mix door is in the full heat position. The blower air flow will now hold the mix door in the proper position.

5. Without disturbing the door link or the output shaft position, tighten the hex screw on the door link, Fig. 1-48.

6. To check the Mix Door Link Adjustment, proceed as follows.

a. Connect Tester J-23678 into the wiring harness and the programmer using Harness Adapter J-24774. Place the control head in "AUTO". Place the "MANUAL-AUTOMATIC" switch in the "MANUAL" position. Using the "MANUAL CONTROL", swing the programmer to "Max. Heat" then to "Max. Cold". Hi blower should be obtained in "MAX COLD" and M_3 in "MAX HEAT".

b. Check for recirculation operation. Operate the system with the "MANUAL CONTROL" on "150" for 5 minutes so the restricted vacuum line can move the outside air door to the outside air position. With the control head in "HI", move the "MANUAL CONTROL" to "Max. Cold". With all the car doors and windows closed, the blower noise level should increase when recirculation occurs (approximately 3 minute delay due to the restrictor).

c. Programmer Amplifier Calibration (Feedback "Pot" Adjustment)

1. Remove the plastic cover from the programmer while it is still mounted in the car.

2. Connect the Tester J-23678 into the wiring harness and the programmer using Harness Adapter J-24774.

3. Place the control head selector lever in the "AUTO" position.

4. Place the "MANUAL-AUTOMATIC" switch on the tester in the "MANUAL" position.

5. Place the "TEMPERATURE DIAL CALIBRATOR" switch of the tester in the "OFF" position.

BACK TO INDEX

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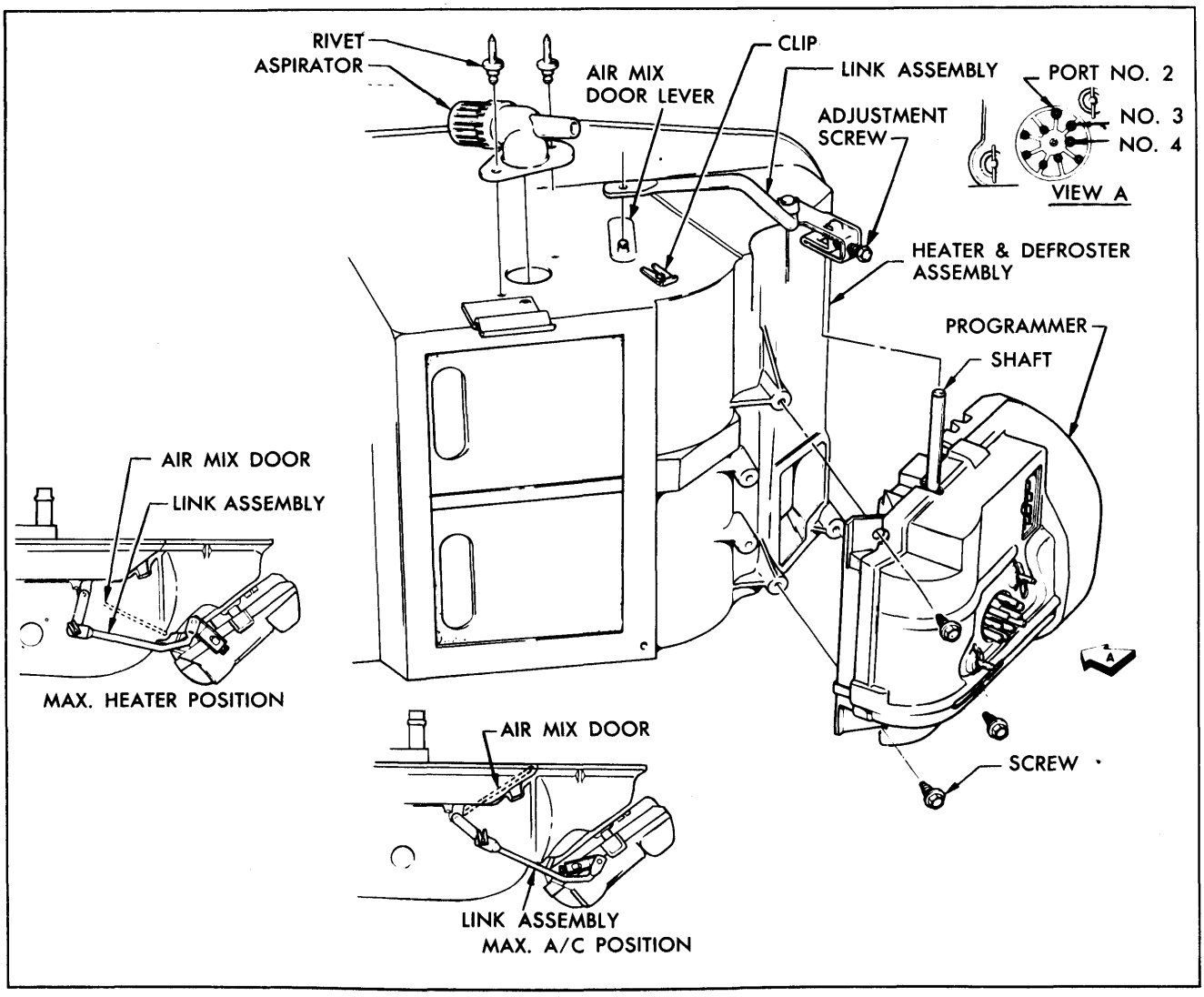


Fig. 1-48 Programmer Installation and Adjustment

6. Rotate the "MANUAL CONTROL" knob on the tester to the "Max. Heat" position. The programmer should move to the full heat position.

7. Rotate the "MANUAL CONTROL" knob to 180 and STOP. DO NOT OVER-TRAVEL!

8. Using a blade type screwdriver, slip the shaft of the feedback potentiometer fully counterclockwise to its stop (see Figure 1-127 for location of the feedback potentiometer in the programmer). The vacuum motor mechanism will be "in" the vacuum motor indicating full heat operation.

9. Using the screwdriver, very slowly slip the feedback potentiometer clockwise until the first movement of the vacuum motor mechanism can be seen. Stop the adjustment when the movement first occurs. (Do not watch the programmer output shaft.)

10. To check the adjustment, rotate the "MANUAL CONTROL" knob to the "Max. Heat" position. Then slowly rotate the "MANUAL CONTROL" knob counterclockwise and the vacuum motor mechanism should first start to move when the "MANUAL CONTROL" knob is exactly at 180 ± 1. Touch up the feedback potentiometer adjustment in the programmer so that the mechanism movement occurs at exactly 180. If this adjustment cannot be made, the programmer is malfunctioning.

d. Compressor Drive Belt

The compressor drive belt is adjusted at the power steering pump. Follow procedure described in Section 6, Note 10.

TORQUE SPECIFICATIONS
METAL TUBING

Metal Tube O.D. (Inch Lbs.)	Steel Tubing Torque (Ft. Lbs.)	Alum. Tubing Torque (Ft. Lbs.*)
1/4"	15	7
3/8"	35	13
1/2"	35	13
5/8"	35	21
3/4"	35	28

*Torque taken with crow foot attachment at a 90° angle on torque wrench.

BACK TO INDEX

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SERVICE INFORMATION — FRONT A/C ALL SERIES
REMOVAL AND INSTALLATION PROCEDURES

16. Compressor (Complete Removal and Installation)

a. Removal

1. Remove air cleaner.
2. Purge refrigerant from system as described in Note 12.
3. Remove screw securing high and low pressure line manifold to compressor rear head.
4. Remove high and low pressure manifold from compressor rear head and cap openings in both hoses and compressor. Test Plate, J-9625 may be used to seal compressor.
5. Disconnect electrical connectors from clutch coil and superheat switch.
6. Loosen bolts securing power steering pump to mounting brackets, pivot pump toward engine and remove drive belt from compressor.
7. Remove spark plug wires from right hand cylinder head and position wires out of way.
8. Remove two screws holding compressor to rear mounting bracket.
9. Remove two screws holding compressor to front mounting bracket.
10. Remove compressor by moving upward and out from under radiator hose.

b. Installation

(NOTE: Before installing a replacement compressor, make certain the numerals 3 3/4 (5 on Fleetwood Seventy-Fives) are stamped 1/8 inch high on blank space provided in lower right hand corner of compressor name plate. If numeral is not evident, then stamp numeral as indicated. This numeral indicates the refrigerant capacity and must be shown on all compressors as required by law in some states.)

1. Position compressor to engine and secure with two screws each to front and rear mounting brackets. Tighten front bolts to 25 ft. lbs. torque.
2. Install compressor drive belt on compressor and power steering pump and adjust belt tension as described in Section 6, Note 10.
3. Connect electrical connectors to clutch coil and superheat switch.
4. Remove test plate J-9625 and using new O-ring, position high and low pressure manifold to rear head and secure with one screw. Tighten screw to 30 ft. lbs. torque.

(NOTE: The O-rings in the compressor head should be oiled prior to placement in the cavity. Care should be taken not to damage these O-rings during installation.)

5. Install spark plug wires to right hand cylinder head.
6. Evacuate and charge refrigeration system as described in Note 12.
7. Leak test all compressor connections.

CAUTION: All leaks must be repaired. Under no circumstances should a compressor be operated when a leak exists. Loss of refrigerant prevents oil return to the compressor and operating compressor may damage it.

8. Install air cleaner.

17. Compressor (Partial Removal and Installation)

In order to perform certain engine operations, it is necessary to move the compressor out of the way. This can be done without discharging the refrigeration system as follows:

a. Removal

1. Remove air cleaner.
2. Perform steps 5 thru 9 of Note 16a.
3. Move complete assembly clear of work area, being careful not to kink hoses. Use rope or wire to hold compressor out of way.

b. Installation

1. Perform steps 1, 2, 3 and 5 of Note 16b.
2. Check system operation to assure that no refrigerant was lost and system performs normally.
3. Install air cleaner.

18. Evaporator Case

a. Removal

1. Discharge refrigeration system as described in Note 12.
2. Remove electrical connectors from ambient sensor, ambient switch, thermal limiter fuse and auto blower relay, Fig. 1-38.
3. Route harness out from behind EEVIR assembly and position out of way.
4. Disconnect ALC compressor hoses and remove hoses from behind EEVIR assembly. Position out of way.
5. Remove blower motor as described in Note 31.
6. Remove antenna lead-in cable.
7. Remove ALC compressor by removing three screws accessible in wheel opening.
8. Remove brace between cowl and wheelhouse at bottom near frame by removing three screws at wheelhouse and two screws at cowl (C-car only).
9. Remove high and low pressure lines from EEVIR assembly and position out of way.

CAUTION: All line connections and EEVIR openings must be plugged or sealed immediately to prevent entry of dirt and moisture into system.

BACK TO INDEX

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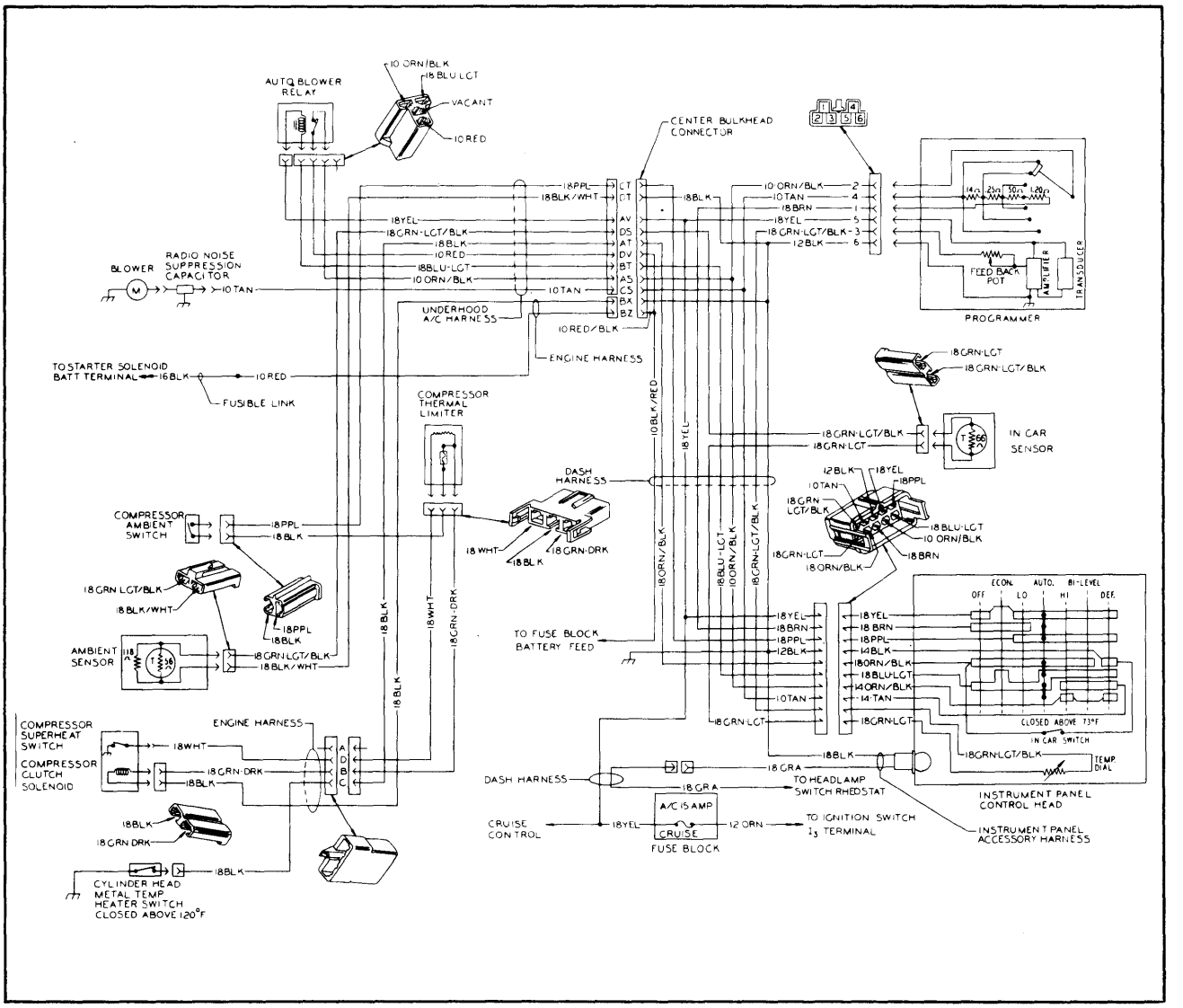


Fig. 1-49 Climate Control Electrical Circuit Diagram

10. Remove right-hand tie-strut at wheelhouse and position out of way (C-car only).

11. Remove two nuts and four screws securing evaporator case to cowl, Fig. 1-2.

12. Move evaporator case away from cowl and cut gasket at air-inlet-to-evaporator case joint. Push air inlet back into cowl.

13. Remove evaporator case by twisting out from under hood hinge.

b. Installation

1. Position evaporator case to cowl making sure gasket will seal properly where it has been cut. Use sealer as required.

2. Loosely install two nuts and four screws holding evaporator case to cowl, Fig. 1-2.

3. Tighten fasteners installed in Step 2 to 12 in. lbs.

4. Connect high and low pressure lines to EEVIR assembly using new O-rings.

5. Position right-hand tie-strut to wheelhouse and secure with two nuts. Tighten nuts to 20 in. lbs. (C-car only).

6. Install brace between cowl and wheelhouse at bottom near frame by installing three screws at wheelhouse and two screws at cowl. Tighten wheelhouse screws to 20 ft. lbs. and cowl screws to 20 ft. lbs. (C-car only).

7. Install ALC compressor and secure with three screws accessible in wheel opening. Tighten screws to 60 in. lbs.

8. Route ALC vacuum hoses behind EEVIR assembly and connect to compressor. Yellow hose to top port, black hose to bottom port.

9. Install antenna lead-in cable.

10. Install blower motor as described in Note 31.

11. Route electrical harness behind EEVIR assembly and make connections at ambient sensor, ambient switch, thermal limiter fuse and blower auto relay, Fig. 1-38.

12. Evacuate and charge refrigeration system as described in Note 12. Leak test all connections.

BACK TO INDEX

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19. Condenser Removal and Installation (Partial)

In order to perform certain engine operations, it is necessary to move the condenser out of the way. This can be done without disconnecting any lines as follows.

a. Removal

1. Remove four screws each side securing radiator upper brackets to cradle and fan shroud. Remove brackets.
2. Remove four clips, two each side, securing acromat to condenser frame.
3. Remove fresh air inlet from position on radiator cradle.
4. Remove four nuts, two each side, securing condenser mounting brackets to rubber mounts.
5. Remove clip securing liquid line to radiator cradle.
6. Pivot condenser out of cradle and allow to rest lightly on lines. secure condenser in this position by fastening to hood.

b. Installation

1. Pivot condenser into position in radiator cradle so that all four mounting brackets are resting on rubber cushions.
2. Secure mounting brackets to rubber cushions with four nuts, two each side.
3. Install two clips at each side securing acromat to condenser frame.
4. Secure liquid line at radiator cradle with clip and screw.
5. Install upper radiator brackets at each side of radiator and secure with two screws to cradle and fan shroud.
6. Position fresh air inlet to radiator cradle and secure with one screw.

20. Condenser

a. Removal

1. Purge system as described in Note 12.
2. Remove two screws securing upper radiator mount bracket at each side of radiator cradle and remove two screws, one each side securing wheelhouse brace to bracket. Remove bracket.
3. Disconnect high pressure vapor line.
4. Remove clip securing liquid line to condenser frame.
5. Disconnect liquid line from condenser outlet pipe.
6. Remove four nuts, two each side, securing condenser mounting brackets to rubber mounts.
7. Remove four clips, two each side, that fasten acromat to condenser frame.
8. Remove condenser from chassis.

b. Installation

1. Add refrigerant oil as described in Note 12.
2. With top of condenser tipped rearward, lower condenser into position until lower mounting brackets will go under upper rubber mounts. Tip condenser vertically and lower until all four mounting brackets are resting on rubber cushions.
3. Secure mounting brackets to rubber mounts with four nuts, two each side.
4. Install four clips, two each side holding acromat to condenser frame.
5. Connect high pressure vapor line to condenser using a new O-ring.
6. Connect liquid line from receiver to condenser at outlet pipe using a new O-ring.
7. Install clip securing liquid line to condenser frame.
8. Install two upper radiator mount brackets and secure to cradle with two screws. Secure wheelhouse brace to bracket with one screw at each side.
9. Evacuate system as described in Note 12.
10. Charge system with refrigerant as described in Note 12 and leak test condenser connections.

21. Desiccant Replacement

Replacement of the desiccant is not necessary unless one of the following conditions are encountered.

a. The system has been open for an extended period of time (such as after an accident).

b. There is evidence of moisture in the system.

c. A compressor malfunction requiring cleaning of the refrigeration system.

d. The EEVIR Assembly has been removed from the car for other service.

e. Other instances which your judgement indicates could cause moisture to enter the system.

22. EEVIR Assembly—Removal and Installation

a. Removal

1. Discharge refrigeration system as described in Note 12. While system is discharging, clean surface dirt from exterior of EEVIR assembly and from line connection areas. Blow any loose dirt away with an air hose.
2. When system is completely discharged (high and low sides), loosen and remove suction, liquid and liquid bleed line connections from EEVIR assembly.

CAUTION: All line connections and EEVIR openings must be plugged or sealed immediately to prevent entry of dirt and moisture into system.

3. Loosen evaporator inlet and outlet connection nuts at EEVIR assembly.
4. Remove EEVIR mounting clamp (1 screw) from liquid receiver and carefully slide EEVIR assembly off of evaporator outlet tube first and then off of evaporator inlet tube. Plug or seal all openings.

(NOTE: Whenever EEVIR assembly is removed from car, drier desiccant should be changed. Refer to Note 21 for desiccant replacement policy).

BACK TO INDEX

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b. Installation

1. Before installing EEVIR assembly, obtain set of new line connection O-rings. Lubricate all new O-rings liberally with clean refrigerant oil.

CAUTION: When making connections use care to avoid nicking O-rings or cross threading connection threads.

2. Remove plugs from evaporator inlet and outlet tubes and corresponding EEVIR assembly openings. Install new O-rings and position EEVIR assembly to evaporator inlet tube first and then to outlet tubes, Fig. 1-50. When EEVIR assembly is in proper position, install mounting clamp.

3. Tighten evaporator inlet connection to 15-20 ft. lbs. torque and evaporator outlet connection to 28-33 ft. lbs. torque.

4. Remove plugs from liquid bleed line and corresponding EEVIR assembly opening, install new O-ring and connect line to EEVIR assembly. Tighten connection to 5-7 ft. lbs. torque.

5. Remove plugs from liquid line and corresponding EEVIR assembly opening, install new O-ring and connect line. Tighten connections to 11-13 ft. lbs. torque.

6. Remove plugs from suction line and corresponding EEVIR assembly opening, install new O-ring and connect line to EEVIR assembly. Tighten connection to 28-33 ft. lbs. torque.

7. Evacuate, leak check and charge refrigerant system, as described in Note 12.

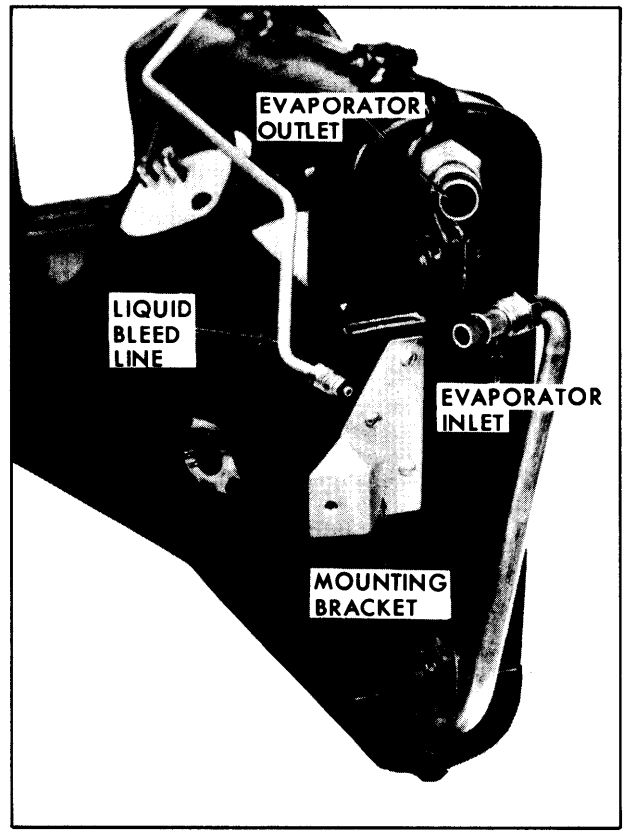


Fig. 1-50 Evaporator Connections

23. Drier Desiccant—Removal and Installation

a. Removal

(NOTE: Refer to Note 21 for Desiccant Replacement Policy.)

1. Discharge refrigeration system as described in Note 12. While system is discharging, clean surface dirt from exterior of EEVIR assembly. Blow any loose dirt away with an air hose.

2. When system is completely discharged, loosen receiver shell to valve housing retaining screws approximately three turns.

WARNING: FOR PERSONAL SAFETY, DO NOT REMOVE SCREWS ENTIRELY UNTIL INSTRUCTED TO DO SO.

3. Remove EEVIR mounting screw and bracket from receiver.

4. Hold EEVIR valve housing and push on lower end of receiver to break seal between receiver and valve housing. If receiver sticks and is hard to cock to one side, carefully pry between receiver mounting flange and condenser line connection with a flat-blade screwdriver to free receiver.

5. Remove (6) mounting screws and receiver by lowering downward to clear liquid pick-tube and filter screen. Discard bag of drier desiccant and valve housing-to-receiver O-ring.

6. Drain, measure and discard any oil present in receiver. Remove pick-up tube filter screen. Wash filter screen and interior of receiver shell with clean solvent and blow dry with air hose.

(NOTE: Recommended solvents in order of preference are trichlorethylene, naphtha, stoddard solvent and kerosene.)

b. Installation

1. Lubricate new valve housing to receiver O-ring with clean refrigerant oil and install in groove on valve housing.

2. Add film of clean refrigerant oil at inner top surface of receiver to aid in assembly. Reassemble filter screen to pick-up tube (be sure screen is all the way onto tube).

3. Add to receiver one ounce of clean refrigerant oil, amount drained from receiver in Step 6 of part a above plus amount lost during discharge.

4. Add new bag of drier desiccant to receiver and assemble receiver to valve housing. Tighten receiver mounting screws to 10 ft. lbs.

5. Install EEVIR mounting bracket and retaining screw on receiver.

6. Evacuate, leak check and charge refrigerant system, as described in Note 12.

BACK TO INDEX

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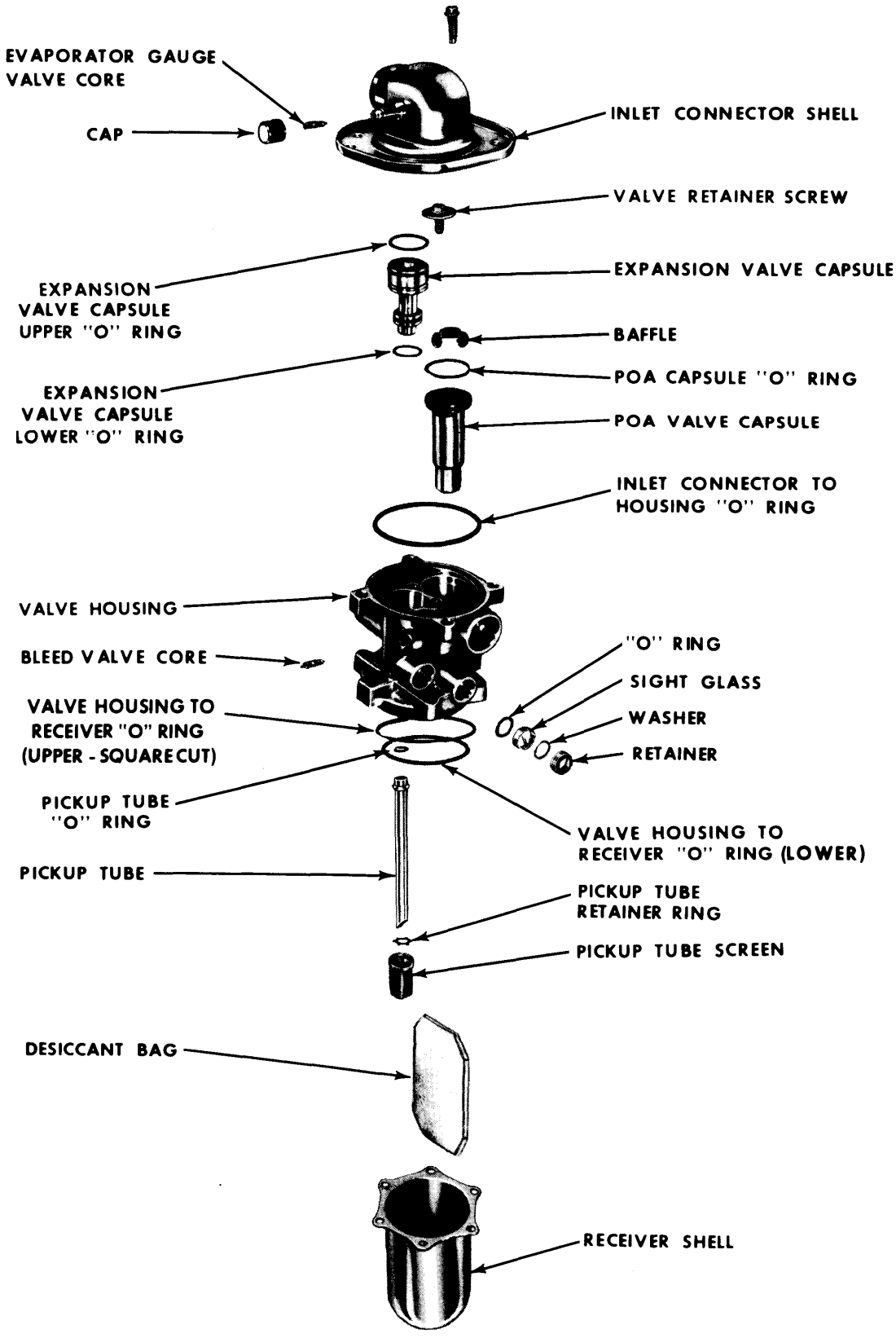


Fig. 1-51 EEVIR Assembly — Exploded View

BACK TO INDEX

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24. STV Valve/X-Valve Capsule—Removal and Installation

a. Removal

1. Discharge refrigeration system as described in Note 12. While system is discharging, clean surface dirt from exterior of EEVIR assembly and from line connection areas. Blow any loose dirt away with an air hose.

2. When system is completely discharged (high and low sides), loosen evaporator outlet tube connection at inlet connector shell.

3. Remove (4) inlet connector shell to valve housing mounting screws.

4. Slip inlet connector shell off of evaporator outlet tube and valve housing; take care to avoid damaging O-ring sealing area of valve housing or scratching O-ring sealing surface of inlet connector shell on valve capsule retaining screws or STV valve baffle. Place inlet connector shell in location where sealing surface of flange will not be scratched or damaged. Discard evaporator outlet tube connection O-ring and inlet connector shell to valve housing O-ring. Cap opening on evaporator outlet tube until ready for assembly.

5. Clean top area of valve housing to remove any dirt dislodged from bottom flange of inlet connector shell during removal. Blow any loose dirt away with an air hose.

6. Loosen both valve capsule retaining screws approximately 3/16 inch.

WARNING: BE CERTAIN COMPLETE REFRIGERANT SYSTEM IS TOTALLY DISCHARGED. ALL PRESSURE MUST BE RELEASED AND BOTH CAPSULES FREED IN THEIR CAVITIES BEFORE REMOVING CAPSULE RETAINING SCREWS.

7. Attach J-24182-1 valve capsule removal tool to tapered groove projection on expansion valve, Fig. 1-52. Position handle of removal tool over one of the screws

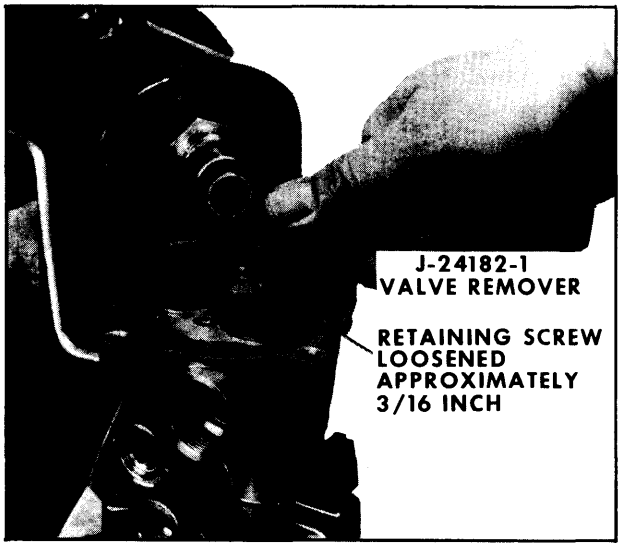


Fig. 1-52 Removing Expansion Valve (X Valve) Capsule

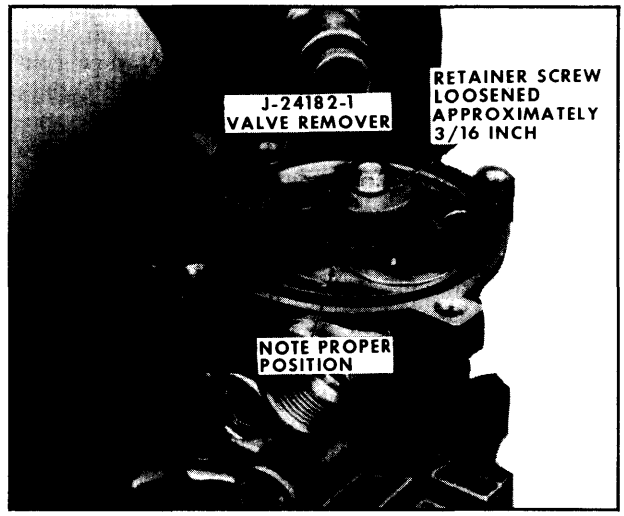


Fig. 1-53 Removing STV Valve Capsule

and press down on handle to lift valve capsule from its cavity.

8. Using opposite end of tool J-24182-1, insert end of tool under STV valve baffle so that step edge of tool clears edge of capsule, Fig. 1-53.

CAUTION: Position fulcrum heel of tool away from valve housing O-ring groove area to prevent damaging groove.

Keep tool firmly engaged in baffle and press down on tool handle to free capsule from cavity.

9. When valve capsules are both free, remove screws and remove expansion valve capsule and STV valve capsule.

10. Remove O-ring from each cavity. Remove O-rings from valve capsule. Discard all O-rings.

b. Installation

1. Wipe both cavities clean with a clean, lint-free cloth if any residue is visible. Lubricate two new X-Valve capsule O-rings and X-Valve cavity with clean refrigerant oil.

2. Install new O-ring in X-Valve cavity and new O-ring on capsule. Carefully install X-Valve capsule in its cavity and press into place by hand.

(NOTE: X-Valve capsule must be gold in color.)

3. Lubricate new STV valve capsule O-ring and valve cavity mounting flange recess with clean refrigerant oil.

CAUTION: Do not install an O-ring in the top groove on EEVIR units or A/C system will not function correctly.

4. Install new O-ring on STV valve capsule and carefully install capsule in its cavity. Press capsule into place by hand.

5. Reinstall valve retaining screws and tighten to 5-7 ft. lbs. torque.

6. Clean entire bottom flange surface of inlet connector shell. Inspect O-ring sealing area of flange for any scratches that could result in a leak.

BACK TO INDEX

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7. Lubricate new inlet connector shell to valve housing O-ring and new evaporator outlet tube connection O-ring with clean refrigerant oil. Install O-rings and carefully position inlet connector shell onto evaporator outlet tube. Start thread of connection nut into inlet connector shell but do not tighten.

CAUTION: Use care in moving inlet connector shell across top of valve housing to prevent scratching sealing surface on flange.

8. Position inlet connector shell over valve housing, install mounting screws and tighten screws to 5-7 ft. lbs. torque.

9. Tighten evaporator outlet tube connection nut to 28-33 ft. lbs. torque.

10. Evacuate, leak check and charge refrigerant system, as described in Note 12.

25. Sight Glass-Removal and Installation

a. Removal

1. Discharge refrigeration system as described in Note 12. While system is discharging, clean surface dirt from exterior of EEVIR assembly and from line connection areas. Make certain sight glass area is clean. Blow any loose dirt away with an air hose.

2. When system is completely discharged (high and low sides), remove sight glass retaining nut by using 7/16" male hex drive tool or allen wrench.

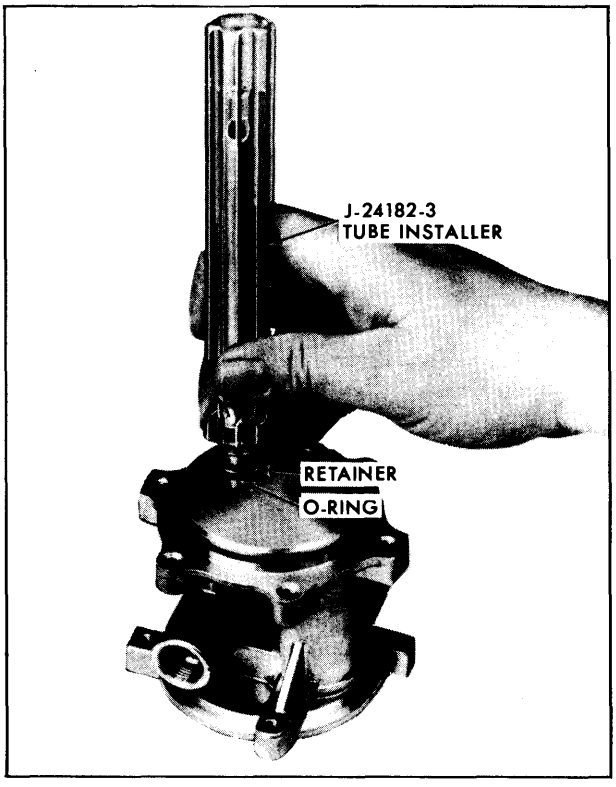


Fig. 1-54 Installing Pick Up Tube

3. Hold finger in sight glass opening to lightly hold glass. Slightly pressurize system with refrigerant vapor to force sight glass and thrust washer out of opening and against finger.

(NOTE: It may be necessary to shift finger pressure from side to side to guide sight glass out of opening but only a very minimum refrigerant pressure is necessary to expel sight glass.)

4. Remove sight glass O-ring. Discard all sight glass parts (glass, O-ring, thrust washer and nut) and obtain sight glass parts kit for re-assembly.

b. Installation

1. Coat new O-ring, sight glass, nylon thrust washer and retaining nut with clean refrigerant oil and install parts in that order into EEVIR assembly being careful to prevent dirt getting on parts. Tighten retaining nut to 20-25 in. lbs. torque.

2. Evacuate, leak check and charge refrigerant system as directed in Note 12.

26. Pickup Tube

Complete disassembly of the EEVIR assembly will require the use of J-24182-3 to install the pickup tube retainer. Refer to Fig. 1-54 for this operation.

27. Liquid Bleed Valve Core/Evaporator Gage Valve Core—Removal and Installation

a. Removal

1. Discharge refrigeration system as described in Note 12.

2. Remove cap from valve connection.

3. Using J-24182-2 valve core remover and installer, remove and discard valve core, Fig. 1-55.



Fig. 1-55 Removing Valve Core

BACK TO INDEX

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b. Installation

1. Install new core by turning core inward until core threads just start to tighten. Fig. 1-55. Note position of J-24182-2 and tighten core an additional one-half turn (180° rotation of tool). This will provide an approximate torque of 24-36 ounce inches.

CAUTION: Evaporator gage fitting and liquid bleed valve use different valve cores; always make certain that proper core is used. Evaporator gage core is blue in color while bleed core is gold or red in color.

2. Evacuate, leak check and charge refrigerant system as described in Note 12.
3. Install cap on valve connection.

28. Programmer

a. Removal

1. Open glove compartment door and remove compartment liner as described in Section 12, Note 94a.
2. Disconnect vacuum harness from programmer vacuum valve.
3. Disconnect electrical harness from programmer.
4. Disconnect door link from programmer output shaft.
5. Remove three screws securing programmer to heater case and remove programmer.

b. Installation

1. Position programmer to heater case - secure with three screws.
2. Connect electrical connector to programmer.
3. Connect vacuum harness to programmer vacuum valve. Secure harness with clips on pins of valve.
4. Install door link and adjust as described in Note 15b.
5. Install glove compartment liner as described in Section 12, Note 94b.

29. Evaporator Case

a. Removal

1. Discharge system as described in Note 12.
2. Remove electrical connections from ambient sensor, ambient switch, low refrigerant limiter and both blower relays. Remove blower ground wire.
3. Support front of hood and tape a pad to the right-hand rear corner.
4. Remove right-hand hood hinge. Note number and placement of shims.
5. Remove high pressure line at EEVIR assembly and position out of way.
6. Remove low pressure line at EEVIR assembly and position out of way.

CAUTION: All line connections and EEVIR openings must be plugged or sealed immediately to prevent entry of dirt and moisture into system.

7. Remove right-hand tie strut at wheel house and position out of way.
8. Remove two nuts and four screws securing evaporator case to cowl.
9. Remove three screws holding evaporator case to air inlet and separate evaporator case from air inlet. Gasket must be cut apart at air inlet-to-evaporator case joint.
10. Remove vacuum hose from recirc. door actuator. Remove evaporator case and air inlet.

b. Installation

1. Position air inlet near cowl and connect vacuum hose to recirc. door actuator. Install sealer any place that gasket has separated.
2. Position evaporator case near cowl and secure to air inlet with three screws.
3. Secure evaporator case to cowl with four screws and two nuts.
4. Connect high pressure line to EEVIR assembly using a new O-ring.
5. Connect low pressure line to EEVIR assembly using a new O-ring.
6. Install right-hand tie strut to wheel house.
7. Install right-hand hood hinge.

(NOTE: Install shims as removed.)

8. Remove hood support and pad from corner of hood.
9. Make electrical connections to ambient sensor, ambient switch, low refrigerant limiter and blower relays. Install blower ground wire.
10. Evacuate and charge refrigeration system as described in Note 12 and leak test all connections.

30. Evaporator Core

a. Removal

1. Discharge system as described in Note 12.
2. Remove EEVIR assembly as described in Note 22a.
3. Remove right side tie strut at wheel house, position out of way.
4. Remove two nuts and four screws securing evaporator case to cowl.
5. Move evaporator case away from cowl and remove six screws holding halves of case together.
6. Remove case half and remove core from case. Case to cowl gasket must be cut where halves separate.

b. Installation

1. Install evaporator core in position in case. Install evaporator case half and secure with six screws.
2. Seal the junction where the case halves were split with sealer and move evaporator case into position on cowl.
3. Secure evaporator case to cowl with two nuts and four screws.
4. Install EEVIR assembly as described in Note 22b.
5. Position right-hand tie strut and secure with two nuts.
6. Evacuate and charge refrigeration system as described in Note 12 and leak test all connections.

BACK TO INDEX

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31. Blower Motor

a. Removal

1. Disconnect negative battery cable.
2. Remove rubber cooling hose from nipple and blower motor.
3. Disconnect electrical connector at lead to motor.
4. Remove six screws securing blower to case and remove blower.

b. Installation

1. Install ground wire and capacitor to blower flange screw at 5 o'clock position.
2. Place a bead of sealer around opening where blower will contact case.
3. Guide blower motor against cowl and place on locating dowel.
4. Install five screws securing blower to case.
5. Connect electrical connector at lead to motor.
6. Install cooling hose on motor and nipple.

32. Heater Case

a Removal

1. Drain radiator.
2. Remove hoses from heater core nipples and plug nipples to prevent spilling coolant remaining in core.
3. Remove instrument panel pad as described in Section 12, Note 59a.
4. On cars with Air Cushion Restraint System, perform following operations:

a. Remove right hand lower trim cover as described in Section 12, Note 107a.

b. Remove Air Cushion Assembly as described in A.C.R.S. service manual.

5. Remove center A/C outlet support and connector from position between cowl and horizontal support, Fig. 1-56.
6. Remove left A/C outlet hose from A/C distributor.
7. Remove center support and associated braces as shown in Fig. 1-56.
8. Remove two screws securing A/C distributor to heater case and remove distributor, Fig. 1-56.
9. Remove one screw securing defroster nozzle and remove nozzle.
10. On cars without Air Cushion Restraint, remove glove compartment liner as described in Section 12, Note 94a.
11. Remove vacuum and electrical connectors from programmer.
12. Disconnect vacuum hose from recirc door actuator, defroster door actuator, mode door actuators and position vacuum harness out of way, Fig. 1-57.
13. Disconnect aspirator hose from in-car sensor.
14. Remove three nuts and one screw securing heater case to cowl on engine side of cowl, Fig. 1-3.

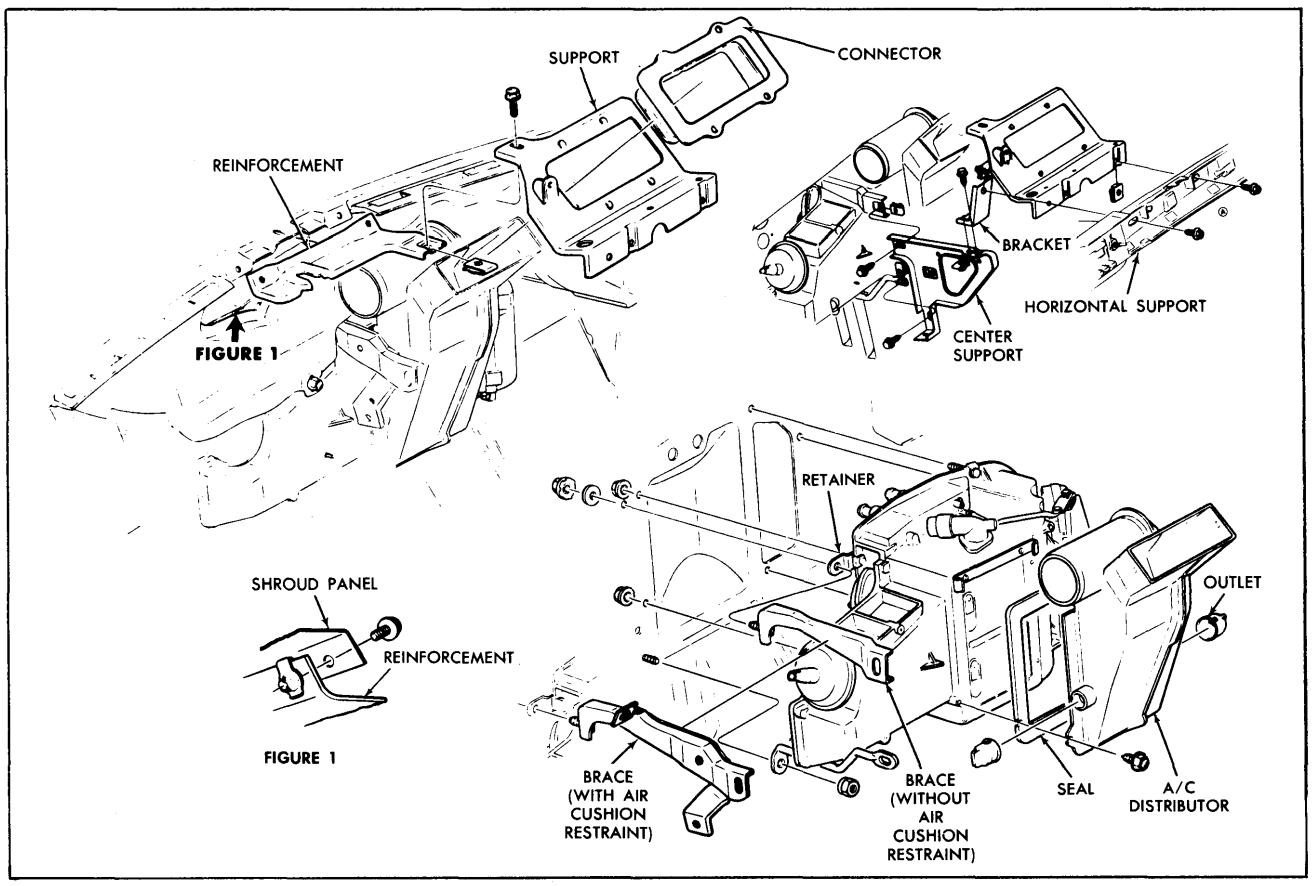


Fig. 1-56 Heater Case Assembly

BACK TO INDEX

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15. Remove heater case from position under instrument panel.

b. Installation

1. Position heater case to cowl as shown in Fig. 1-3.
2. Screw heater case to cowl with three nuts and one screw.
3. Remove plugs from heater core nipples and install heater hoses.
4. Refill cooling system.
5. Connect vacuum hoses to recirc door actuator, defroster door actuator, mode door actuators and programmer vacuum valve, Fig. 1-57. Position vacuum harness as shown in Fig. 1-57.
6. Connect programmer electrical connector.
7. Connect in-car sensor aspirator hose, Fig. 1-11.
8. Position defroster nozzle and secure with one screw.
9. Position A/C distributor to heater case and secure with two screws, Fig. 1-56.
10. Install left hand A/C outlet hose to A/C distributor.
11. Install center support and associated braces as shown in Fig. 1-56.
12. Position center A/C outlet support and secure with three screws. Install outlet connector.
13. On cars equipped with Air Cushion Restraint system, perform the following operations:

a. Install Air Cushion assembly as described in A.C.R.S. service manual.

b. Install right hand lower trim cover as described in Section 12, Note 107b.

c. Install Knee Restraint as described in Section 12, Note 101b.

14. On cars without Air Cushion Restraint install glove compartment liner.
15. Install instrument panel pad as described in Section 12, Note 59b.
16. Check A/C controls for proper operation.

33. Heater Core

a. Removal

1. Remove heater case as described in Note 32a.
2. Remove rubber seal from around core water nipples.
3. Remove screw and clip from beneath seal.
4. Remove two screws and clip from opposite end of core and remove core from position in case.

b. Installation

1. Locate heater core in position in heater case.
2. Secure bottom of core with clip and two screws.
3. Secure top of core with clip and screw.
4. Install rubber seal over water nipples.
5. Install heater case as described in Note 32b.

34. Water Control Valve

(NOTE: The thermal vacuum valve is installed on 75 Series rear units only and is serviced with the water control valve as an assembly.)

a. Removal

1. Clamp off valve inlet and outlet water hoses.
2. Remove vacuum hose from water control valve.

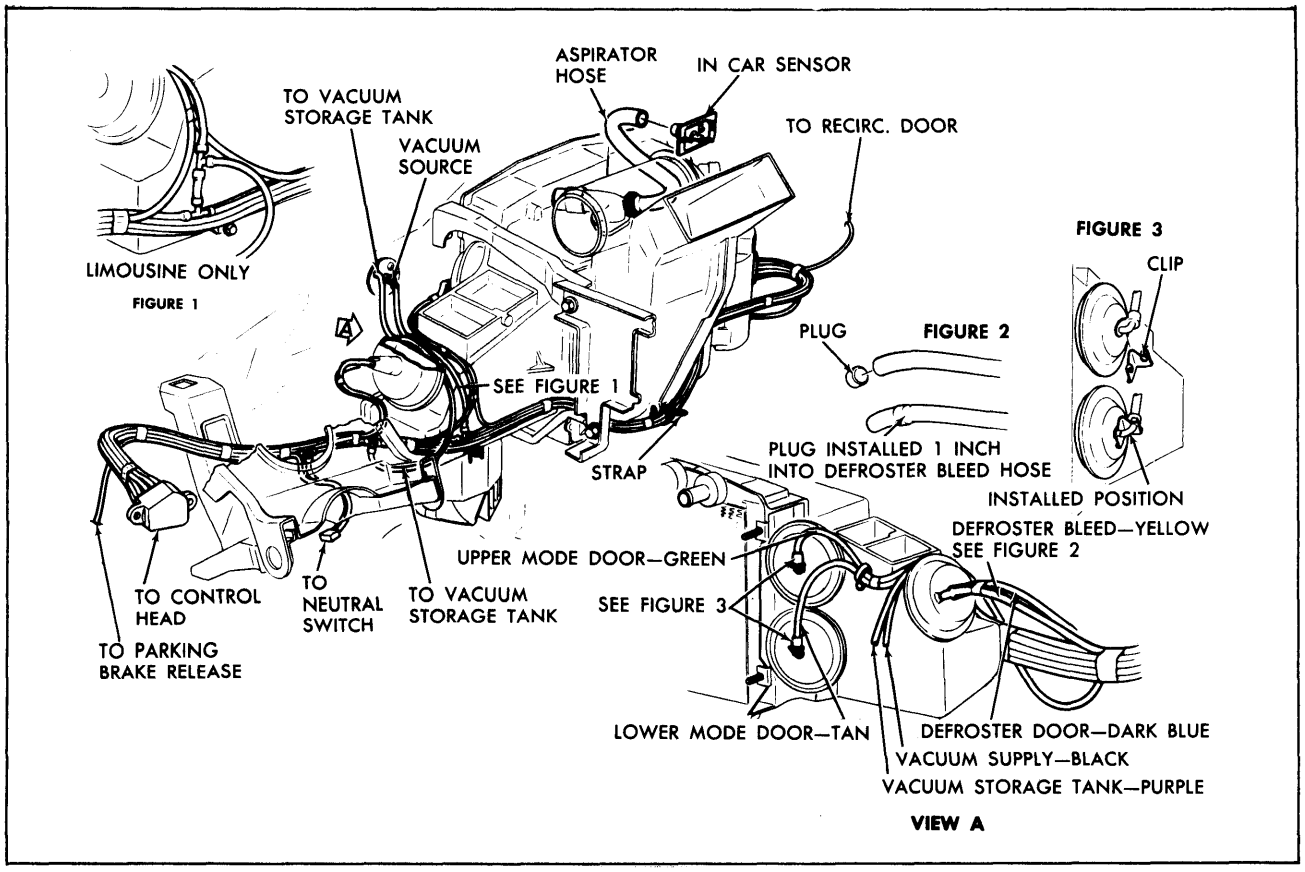


Fig. 1-57 Heater Case Vacuum Connections

BACK TO INDEX

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3. On 75 Series rear units, remove vacuum hoses from thermal vacuum valve.

4. Remove clamps securing hoses to valve, and remove valve from hoses.

b. Installation

1. Install water valve on inlet and outlet hoses and install clamps.

2. Remove clamps from hoses.

3. On all but 75 Series rear units, install white vacuum hose at water control valve.

4. On 75 Series rear units, install red vacuum hose at water control valve. Install yellow and purple vacuum hoses on thermal vacuum valve so yellow hose connects to vacuum nipple closest to water outlet fitting.

5. Replace any coolant lost.

35. Air Conditioning Outlets

The procedures for removing and installing the outlets are described in Section 12, Note 57.

36. In-Car Sensor

The procedure for removing and installing the in–car sensor is described in Section 12, Note 70.

37. Automatic Climate Control Panel

The procedure for removing and installing the control panel is described in Section 12, Note 69.

38. Air Conditioning Control Panel Disassembly and Assembly

The control panel must be removed as described in Section 12, Note 69a to perform any of the following procedures.

a. Circuit Board Removal

1. Remove one screw securing wire harness clip to control head base plate.

2. Remove two green wires from temperature dial rheostat.

3. Remove three screws on bottom of base plate securing circuit board to base plate.

4. Move control lever to "OFF" position and remove circuit board by sliding out from under control lever.

b. Circuit Board Installation

1. Move control lever to "DEF" position and feed circuit board connector and wires through base plate from bottom.

CAUTION: This procedure is important to avoid damage to the wiper contacts on bottom of control lever.

2. Work circuit board into position and secure to base plate with three screws.

3. Working on top side of control head, connect two green wires to temperature dial rheostat, Fig. 1-49.

4. Secure harness clip to base plate with one screw, Fig. 1-49.

c. Temperature Dial Rheostat Removal

1. Disconnect two green leads from rheostat terminals.

2. Remove two screws securing rheostat bracket to mounting plate and remove rheostat.

d. Temperature Dial Rheostat Installation

1. Position rheostat to control panel and install two screws securing rheostat bracket to mounting plate.

2. Connect two green wires to rheostat terminal.

3. After installing control panel on car, adjust temperature dial as described in Note 15a.

e. Control Head Vacuum Valve Removal

1. Loosen two screws securing control vacuum valve to control head and remove valve.

f. Control Vacuum Valve Installation

1. Position control vacuum valve on control head so that pin engages lever arm.

2. Secure with two screws.

39. Superheat Switch

a. Removal

1. Completely discharge air conditioning system as described in Note 12.

2. Remove air cleaner and remove wire from superheat switch.

3. Loosen one screw securing plate retaining high and low pressure connectors to compressor rear head. Remove plate and connectors.

4. Loosen power steering pump to relieve tension on compressor pulley.

5. Remove four screws and one nut securing compressor to engine and prop-up rear of compressor.

6. Remove superheat switch retainer ring using snap ring pliers, J-5403.

7. Remove superheat switch from rear head by pulling at terminal housing groove with a pair of pliers.

8. Remove "O" ring from switch cavity in rear head. Use Oil Pick-Up Tube Remover, J-5139, or a wire with a hook on the end.

9. Recheck superheat switch for closed contacts. See superheat switch check in diagnosis section in Note 6. Replace as necessary.

b. Installation

1. Check cavity and "O" ring groove in rear head for dirt or foreign material and be sure area is clean before installing "O" ring. Lubricate "O" ring liberally with 525 viscosity oil, and install in groove of cavity in rear head.

2. Lubricate housing of superheat switch with 525 viscosity oil and insert switch carefully into switch cavity until switch bottoms.

3. Using Snap Ring Pliers, J-5403, install superheat switch retainer ring with high point of the curved sides next to the switch housing, Fig. 1-58. Be sure the retainer ring is properly seated in the snap ring groove.

4. Check for electrical continuity between switch housing and rear head. Also check for continuity between terminal and switch housing to be sure the contacts are open.

BACK TO INDEX

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5. Return compressor to position on engine and secure with four screws and one nut.

6. Adjust compressor belt tension as described in Section 6, Note 10.

7. Position high and low pressure connectors to rear head and secure with screw.

8. Connect wire to superheat switch and install air cleaner.

9. Evacuate and recharge system with refrigerant, according to the following special charging procedure.

CAUTION: To prevent the possibility of "blowing" the thermal limiter fuse during charging of the system, disconnect the superheat switch and short across terminals "B" and "C" of the wiring harness connector.

a. Evacuate, recharge and leak check entire A/C system according to procedure described in Note 12 Repair any leaks, check anu add oil as required for proper operation of system.

b. When system is operating normally, reconnect thermal limiter fuse.

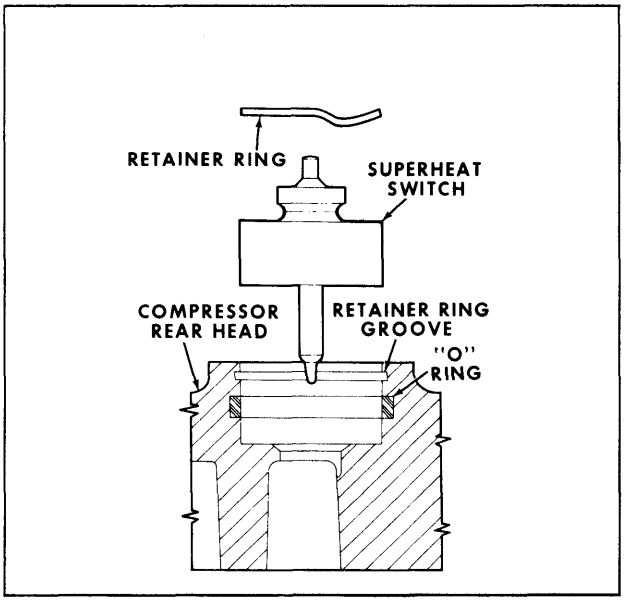


Fig. 1-58 Superheat Switch Retainer

COMPRESSOR SERVICE

40. Compressor Overhaul

For compressor removal and installation, see Note 16. All vehicles use the same air conditioning 6 cylinder compressor. Actual differences between compressors are found in their system refrigerant charge label only which will not affect the following overhaul procedures.

MINOR REPAIR PROCEDURES

The following operations to the Compressor Clutch Plate and Hub, Pulley and Bearing, and Coil Housing are covered as "Minor" because they may be performed WITHOUT FIRST PURGING THE SYSTEM OR REMOVING THE COMPRESSOR from the vehicle.

The Compressor Shaft Seal assembly, Pressure Relief Valve and Superheat Switch may also be serviced WITHOUT REMOVING THE COMPRESSOR from the vehicle but these operations are covered later in this section as "Major Repair Procedures" because the system MUST FIRST BE PURGED of Refrigerant.

Illustrations used in describing these operations show the compressor removed from the vehicle only to more clearly illustrate the various operations.

When servicing the compressor, remove only the necessary components that preliminary diagnosis indicates are in need of service. Refer to Fig. 1-59 and Fig. 1-60 for information relative to parts nomenclature and location.

Removal and installation of external compressor components and disassembly and assembly of internal components must be performed on a clean workbench. The work area, tools, and parts must be kept clean at all times. Parts Tray J-9402 (Fig. 1-92) should be used for all parts being removed, as well as for replacement parts.

Although certain service operations can be performed without completely removing the compressor from the car, the operations described herein are based on bench over-haul with the compressor removed from the car. They have been prepared in sequence in order of accessibility of the components.

Remove compressor as described in Note 16 and position out of way.

CAUTION: Do not kink or place excessive tension on lines or hoses.

When a compressor is removed from the car for servicing, the amount of oil remaining in the compressor should be drained and measured. This oil should then be discarded and new 525 viscosity refrigerant oil added to the compressor (Fig. 1-61).

41. Compressor Clutch Plate and Hub Assembly

a. Removal

1. Place Holding Fixture J-9396 in a vise and clamp the compressor in the Holding Fixture.

2. Keep clutch hub from turning with Clutch Hub Holder J-25030 or J-9403, and remove locknut from end of shaft using Thin Wall Socket J-9399 (Fig. 1-62).

CAUTION: To avoid internal damage to the compressor, DO NOT DRIVE OR POUND on the Clutch Plate and Hub assembly OR on the end of the shaft. If proper tools to remove and replace

BACK TO INDEX

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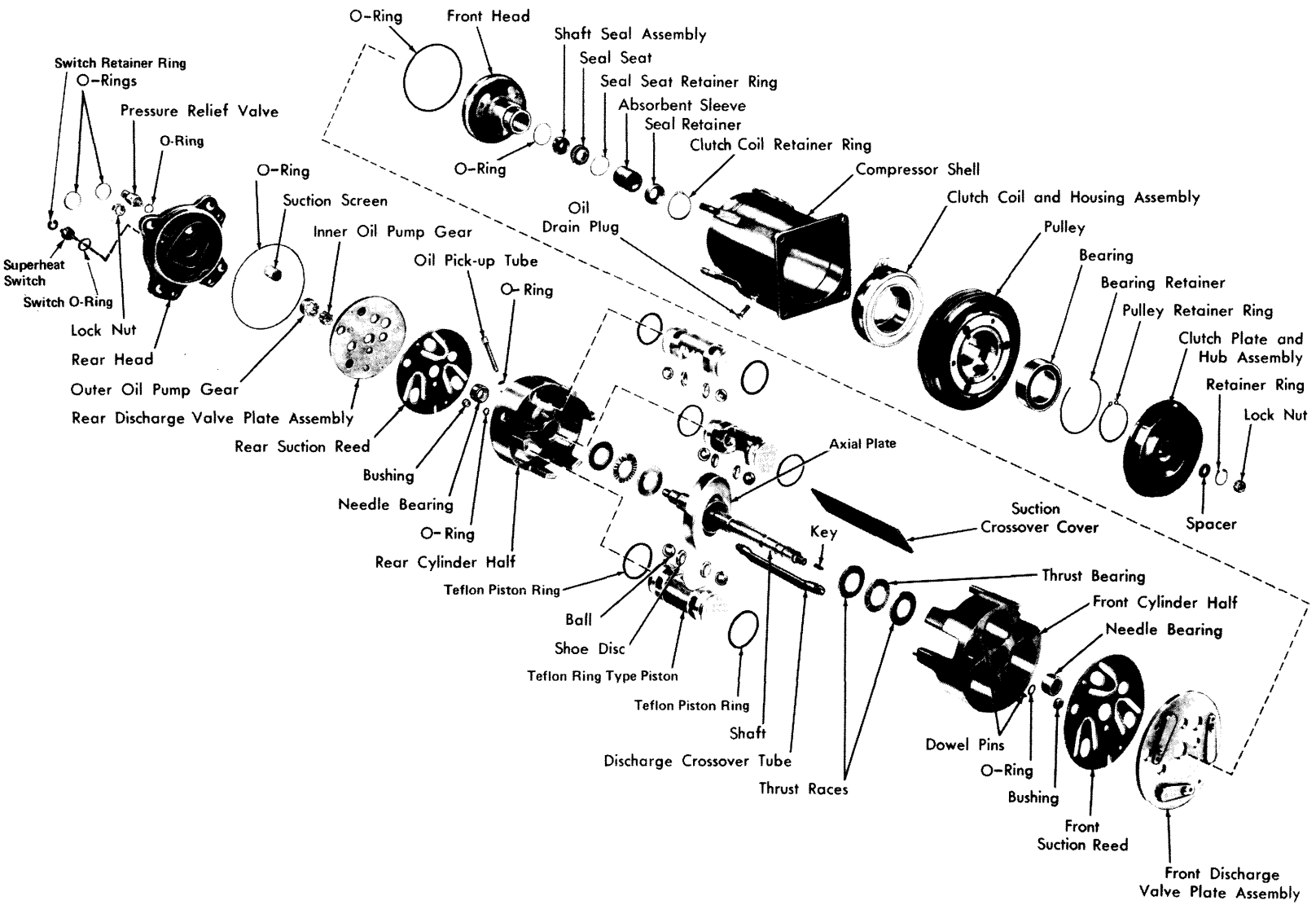


Fig. 1-59 Exploded View of Compressor

BACK TO INDEX

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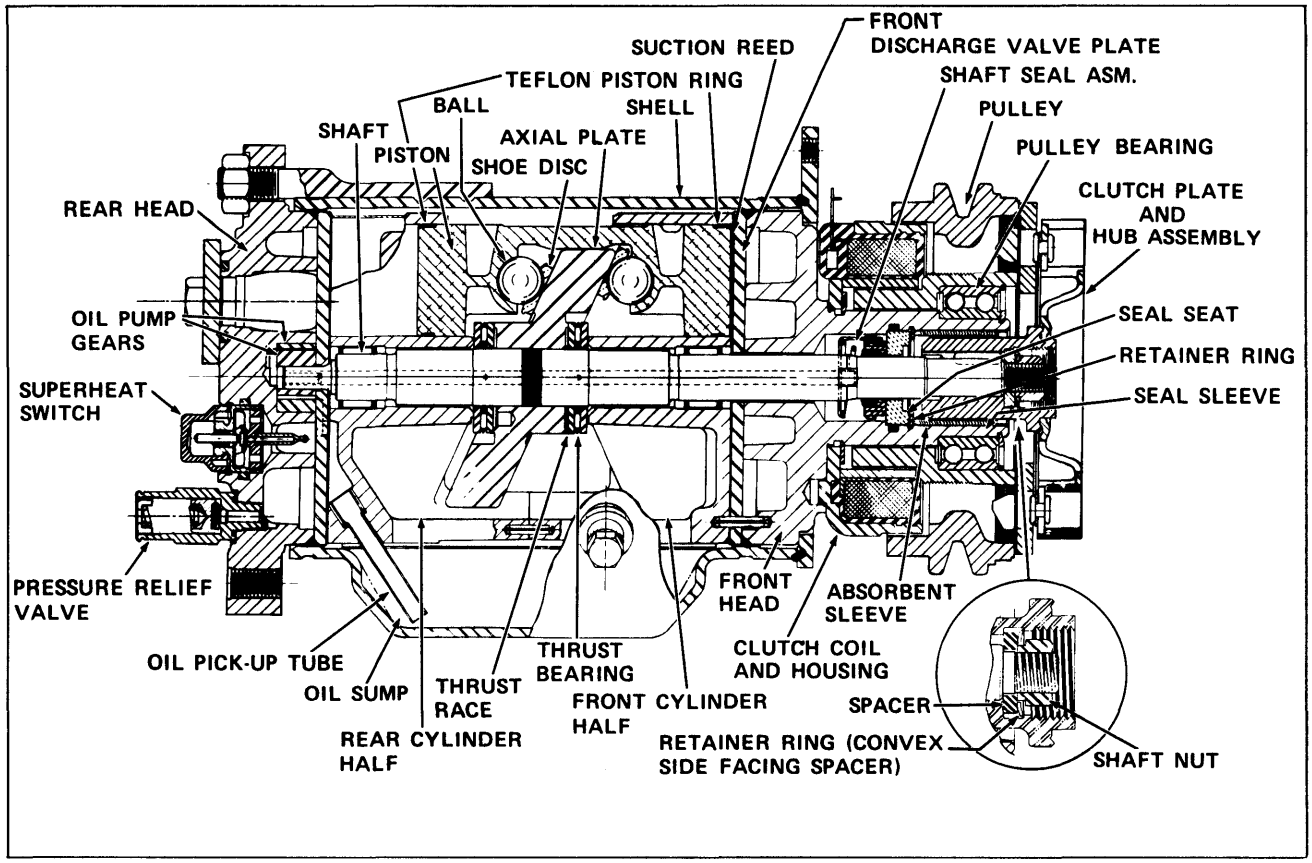


Fig. 1-60 Compressor Cross Section

clutch parts are not used, it is possible to disturb the position of the axial plate (keyed to the main shaft), resulting in compressor damage and seal leakage due to shifting of the crankshaft.

3. Thread Clutch Plate and Hub assembly Remover J-9401 into hub. Hold body of Remover with a wrench and tighten center screw to remove Clutch Plate and Hub Assembly (Fig. 1-63).

4. Remove square drive key from shaft or drive plate hub.

5. Remove hub spacer retainer ring using Snap-Ring Pliers J-5403 (#21), and then remove hub spacer (Fig. 1-64).

6. Inspect driven plate for cracks or stresses in the drive surface. Do not replace driven plate for a scoring condition (Fig. 1-65).

If the frictional surface shows signs of damage due to excessive heat, the clutch plate and hub and pulley and bearing should be replaced. Check further for the underlying cause of the damage (i.e. low coil voltage - coil should draw 3.2 amps at 12 volts - or binding of the compressor internal mechanism, clutch air gap too wide, broken drive plate to hub asm. springs, etc.

b. Installation

1. Insert the square drive key into the hub of driven plate: allow it to project approximately 3/16" out of the keyway.

2. Line up the key in the hub with keyway in the shaft (Fig. 1-66).

3. Position the Drive Plate Installer J-9480-1 on the threaded end of the shaft. The Spacer J-9480-2 should be in place under the hex nut on the tool. This tool has a left hand thread on the body. (Fig. 1-67).

4. Press the driven plate onto the shaft until there is approximately 3/32" space between the frictional faces of the clutch drive plate and pulley.

CAUTION: Make certain key remains in place when pressing hub on shaft.

A ZERO thrust race is approximately 3/32" thick and may be used to roughly gage this operation. Use Clutch Hub Holder J-25030 or J-9403 to hold clutch plate and hub if necessary.

5. Install the hub spacer and, using Snap-Ring Pliers J-5403 (#21), install the retainer ring (see installed Retainer Ring in inset of Fig. 1-60), with convex side of ring facing spacer.

6. Use Thin Wall Socket J-9399 and Clutch Hub Holder J-25030 or J-9403 to install a new shaft locknut with shoulder or circular projection on the locknut facing towards retainer ring. Tighten the nut to 14-26 lb. ft. torque. Air gap between the frictional faces should now be .022" to .057" (Fig. 1-68). If not, check for mispositioned key or shaft.

7. The pulley should now rotate freely.

8. Operate the refrigeration system under MAXimum load conditions and engine speed at 2000 RPM. Rapidly cycle the clutch by turning the air conditioning on-and-off at least 15 times at approximately one second intervals to burnish the mating parts of the clutch.

BACK TO INDEX

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UNIT	ADD OIL
CONDENSOR	1 OUNCE
EVAPORATOR	3 OUNCES
EE–VIR	1 OUNCE

COMPRESSOR CONDITION	AMOUNT OF OIL DRAINED FROM COMPRESSOR	AMOUNT OF OIL TO INSTALL
REPLACING COMPRESSOR WITH A NEW COMPRESSOR.	MORE THAN – 4 OZ.	*DRAIN NEW COMPRESSOR, REFILL WITH NEW OIL (SAME AMOUNT AS DRAINED FROM OLD COMPRESSOR).
	LESS THAN – 4 OZ.	**DRAIN NEW COMPRESSOR. INSTALL NEW OIL IN NEW COMPRESSOR – 6 OZ.
REPLACING COMPRESSOR WITH A SERVICE REBUILT COMPRESSOR.	MORE THAN – 4 OZ.	*SAME AS ABOVE PLUS AN ADDITIONAL OUNCE (MORE OIL IS RETAINED IN A DRAINED COMPRESSOR THAN ONE THAT HAS BEEN REBUILT).
	LESS THAN – 4 OZ.	**SAME AS ABOVE PLUS AN ADDITIONAL OUNCE.
UNABLE TO RUN COMPRESSOR BEING REPLACED, PRIOR TO REMOVAL FROM CAR.	MORE THAN – 1-1/2 OZ. AND SYSTEM APPEARS TO HAVE LOST LITTLE OR NO OIL LESS THAN – 1-1/2 OZ. OR SYSTEM APPEARS TO HAVE LOST MAJOR AMOUNT OF OIL.	*SAME AS ABOVE. **SAME AS ABOVE.
CONTAMINATED OIL DRAINED FROM SYSTEM.	ANY AMOUNT	DRAIN AS MUCH OIL AS POSSIBLE FROM SYSTEM. FLUSH SYSTEM WITH REFRIGERANT-11. REPLACE DRIER DESSICANT AND INSTALL NEW 525 VISCOSITY OIL IN NEW COMPRESSOR: COMP. 10-1/2 OZS.

Fig. 1-61 Compressor Oil Charge for Compressor Unit Replacements

42. Compressor Pulley and Bearing Assembly

a. Removal

1. Remove clutch plate and hub assembly as described in Note 41a. "Compressor Clutch Plate and Hub Assembly" Removal procedure.
2. Remove pulley retainer ring using Snap-Ring Pliers J-6435 (#26), Fig. 1-69.
3. Pry out absorbent sleeve retainer, and remove absorbent sleeve from compressor neck.
4. Place Puller Pilot J-9395 over end of compressor shaft.

CAUTION: It is important that Puller Pilot J-9395 be used to prevent internal damage to compressor when removing pulley. Under no circumstances should Puller be used DIRECTLY against drilled end of shaft.

5. Remove Pulley and Bearing Assembly using Pulley Puller J-8433 (Fig. 1-70).

Inspection

Check the appearance of the pulley and bearing assembly. See Fig. 1-65. The frictional surfaces of the pulley and bearing assembly should be cleaned with a suitable solvent before reinstallation.

b. Installation

1. If original pulley and bearing assembly is to be

BACK TO INDEX

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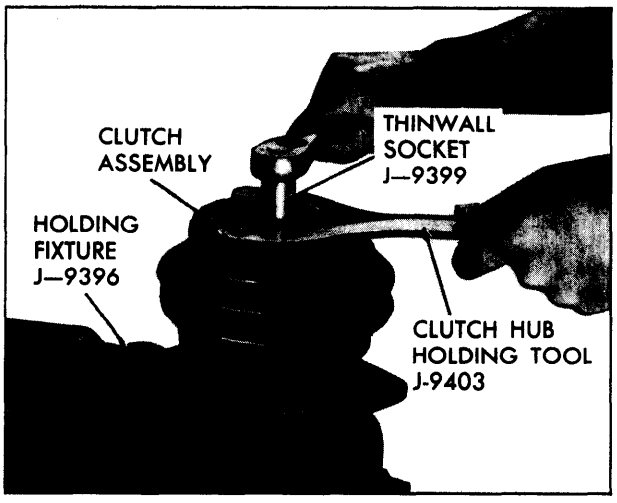


Fig. 1-62 Removing Shaft Lock Nut

reinstalled, wipe frictional surface of pulley clean. If frictional surface of pulley shows any indication of damage due to overheating, the pulley and bearing should be replaced.

2. Check bearing for brinelling, excessive looseness, noise, and lubricant leakage. If any of these conditions exist, bearing should be replaced. See "Compressor Pulley Bearing" Replacement Procedure, Note 43.

3. Press or tap pulley and bearing assembly on neck of compressor until it seats, using Pulley and Bearing Installer J-9481 with Universal Handle J-8092 (Fig. 1-71). The Installer will apply force to inner race of bearing and prevent damage to bearing.

4. Check pulley for binding or roughness. Pulley should rotate freely.

5. Install retainer ring, using Snap Ring Pliers J-6435 (#26).

6. Install absorbent sleeve in compressor neck.

7. Install absorbent sleeve retainer in neck of compressor. Using sleeve from Seal Seat Remover-Installer J-23128, install retainer so that outer edge is recessed 1/32" from compressor neck face.

8. Install clutch plate and hub assembly as described in Note 41b."Compressor Clutch Plate and Hub Assembly" Replacement Procedure.

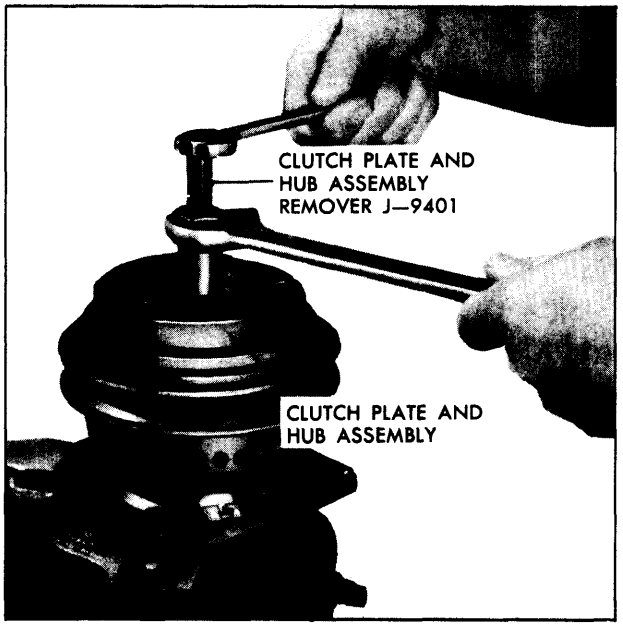


Fig. 1-63 Removing Clutch Plate and Hub Assembly

43. Compressor Pulley Bearing

a. Removal

1. Remove clutch plate and hub assembly as described in Note 41a, "Compressor Clutch Plate and Hub Assembly" Removal procedure.

2. Remove pulley and bearing assembly as described in Note 42a, "Compressor Pulley and Bearing Assembly" Removal procedure.

3. Remove pulley bearing retainer ring with a small screwdriver or pointed tool (Fig. 1-72).

4. Place pulley and bearing assembly on inverted Support Block J-21352 and, using Pulley Bearing Remover J-9398 with Universal Handle J-8092, drive Bearing assembly out of pulley (Fig. 1-73).

b. Installation

Install new bearing in pulley using Pulley and Bearing Installer J-9481 with Universal Handle J-8092 (Fig. 1-74). The Installer will apply the force to the outer race of the bearing.

CAUTION: DO NOT CLEAN NEW BEARING ASSEMBLY WITH ANY TYPE OF SOLVENT. Bearing is supplied with correct lubricant when assembled and requires no other lubricant at any time.

2. Install bearing retainer ring, making certain that it is properly seated in ring groove.

3. Install pulley and bearing assembly as described in Note 42b, "Compressor Pulley and Bearing Assembly" Replacement procedure.

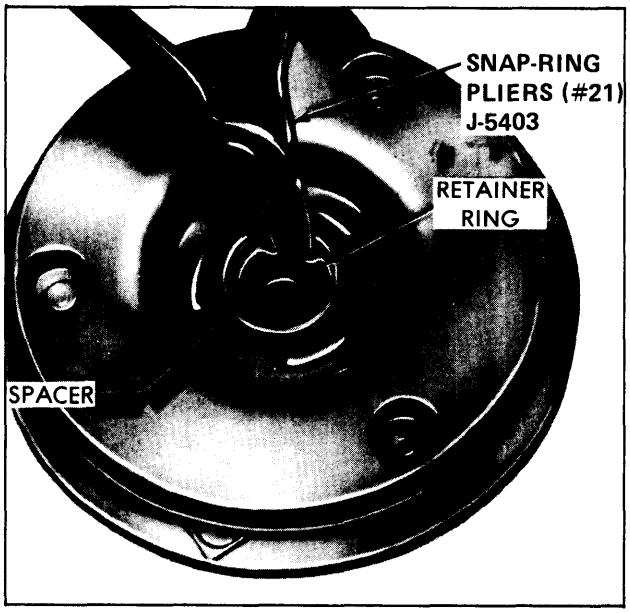


Fig. 1-64 Removing or Installing Retainer Ring In Clutch Drive Plate

BACK TO INDEX

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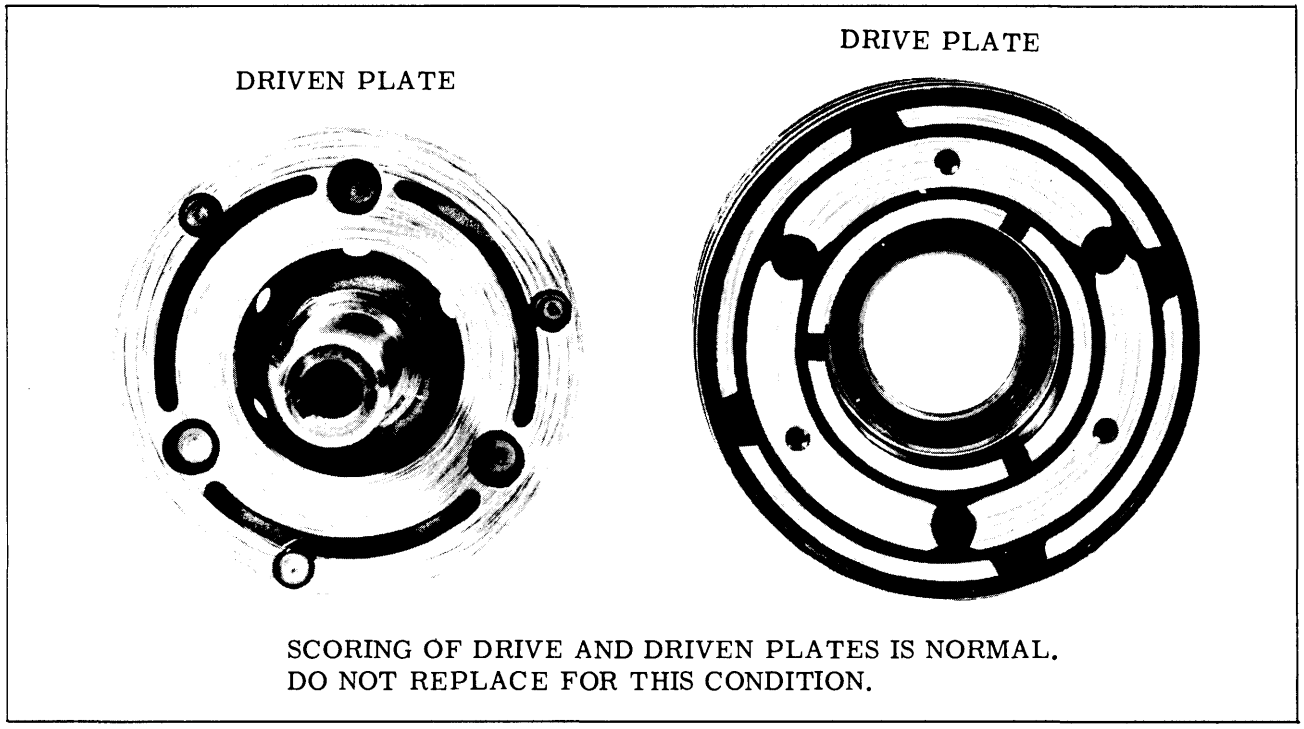


Fig. 1-65 Clutch Driven Plate and Drive Plate

4. Install clutch plate and hub assembly as described in Note 41b, "Compressor Clutch Plate and Hub Assembly" Replacement procedure.

44. Compressor Clutch Coil and Housing Assembly

a. Removal

1. Remove clutch plate and hub assembly as described in Note 41a, "Compressor Clutch Plate and Hub Assembly" Removal procedure.
2. Remove pulley and bearing assembly as described in Note 42a, "Compressor Pulley and Bearing Assembly" Removal procedure.
3. Note position of terminals on coil housing and scribe location on compressor front head castings.

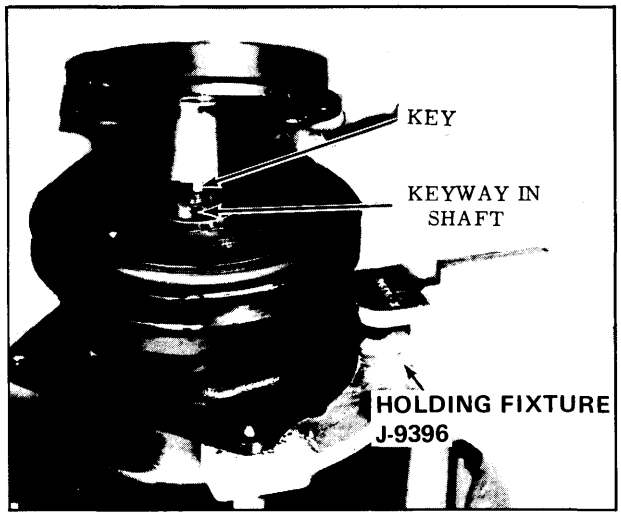


Fig. 1-66 Aligning Drive Plate Key

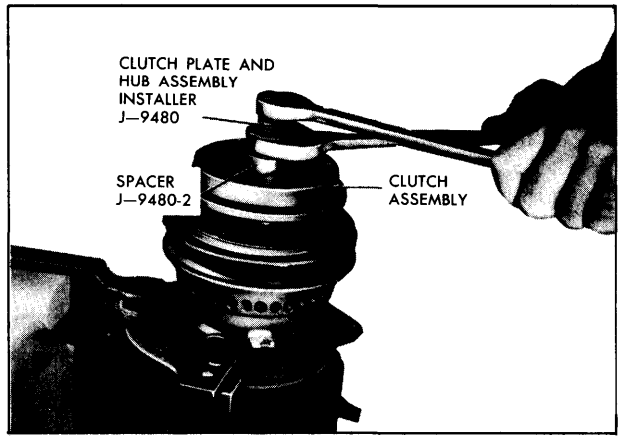


Fig. 1-67 Installing Drive Plate

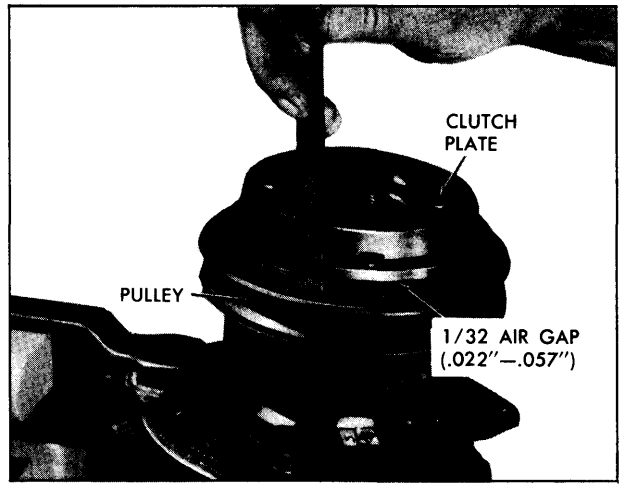


Fig. 1-68 Checking Air Gap

BACK TO INDEX

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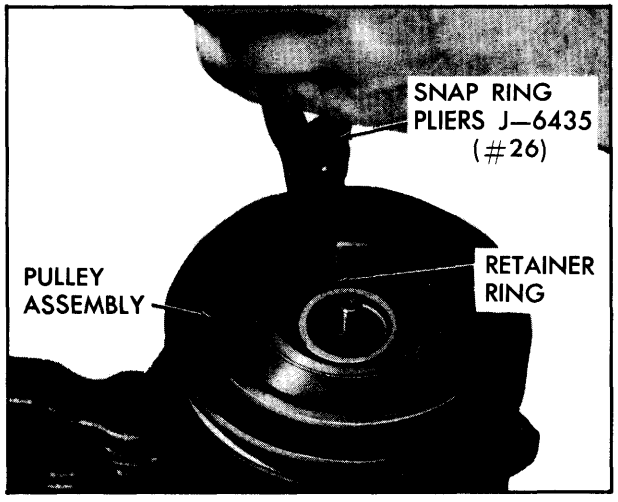


Fig. 1-69 Removing Pulley Retainer Ring

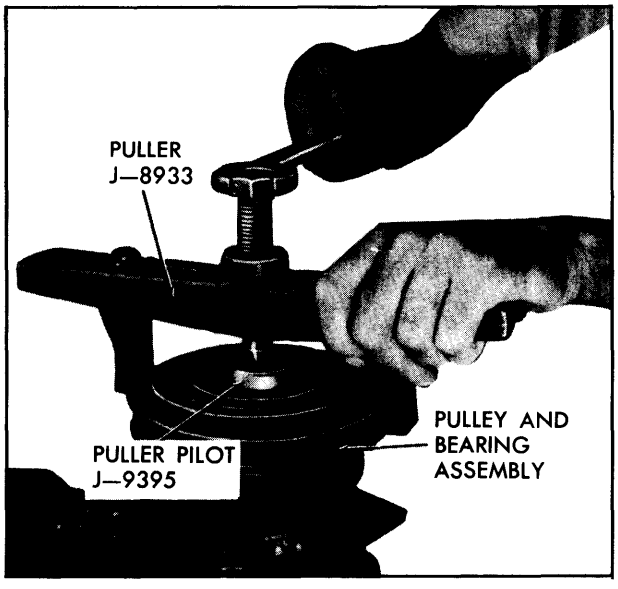


Fig. 1-70 Removing Pulley and Bearing Assembly

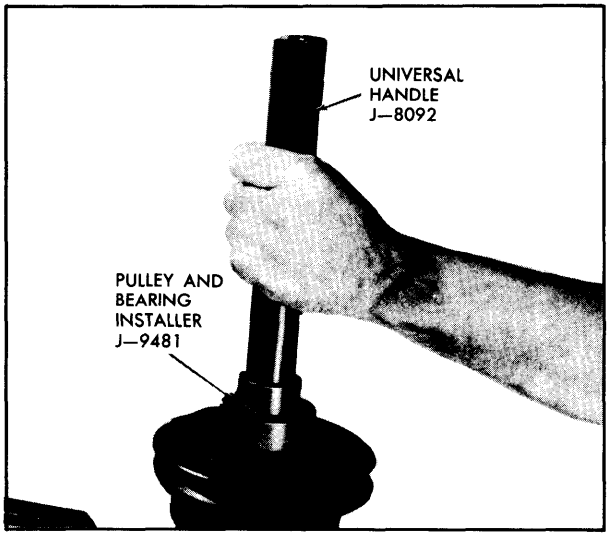


Fig. 1-71 Installing Pulley and Bearing Assembly

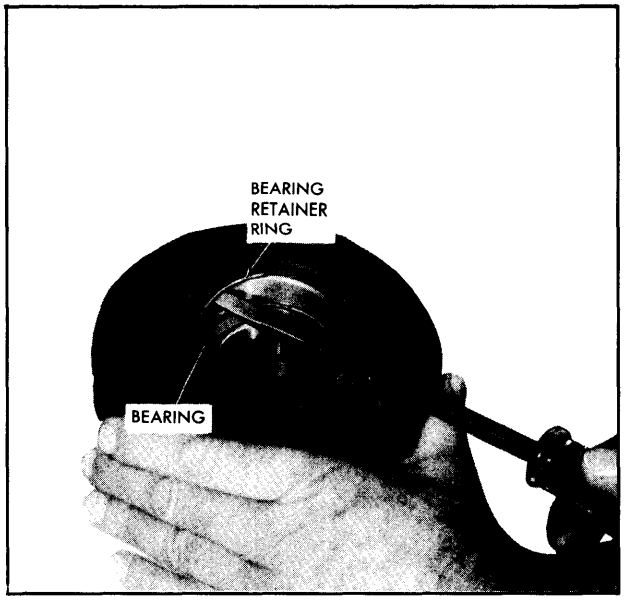


Fig. 1-72 Removing Pulley and Bearing Retainer Ring

4. Remove coil housing retaining ring using Snap-Ring Pliers J-6435 (#26) (Fig. 1-75).
5. Lift Coil and Housing assembly off compressor.

b. Installation

1. Position coil and housing assembly on compressor front head casting so that electrical terminals line up with marks previously scribed on compressor (Fig. 1-76).

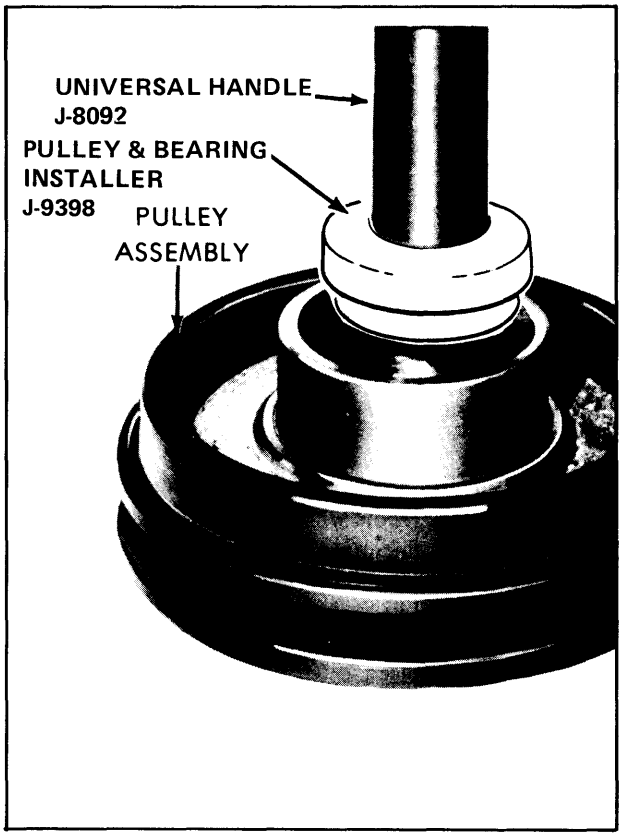


Fig. 1-73 Removing Bearing from Pulley Assembly

BACK TO INDEX

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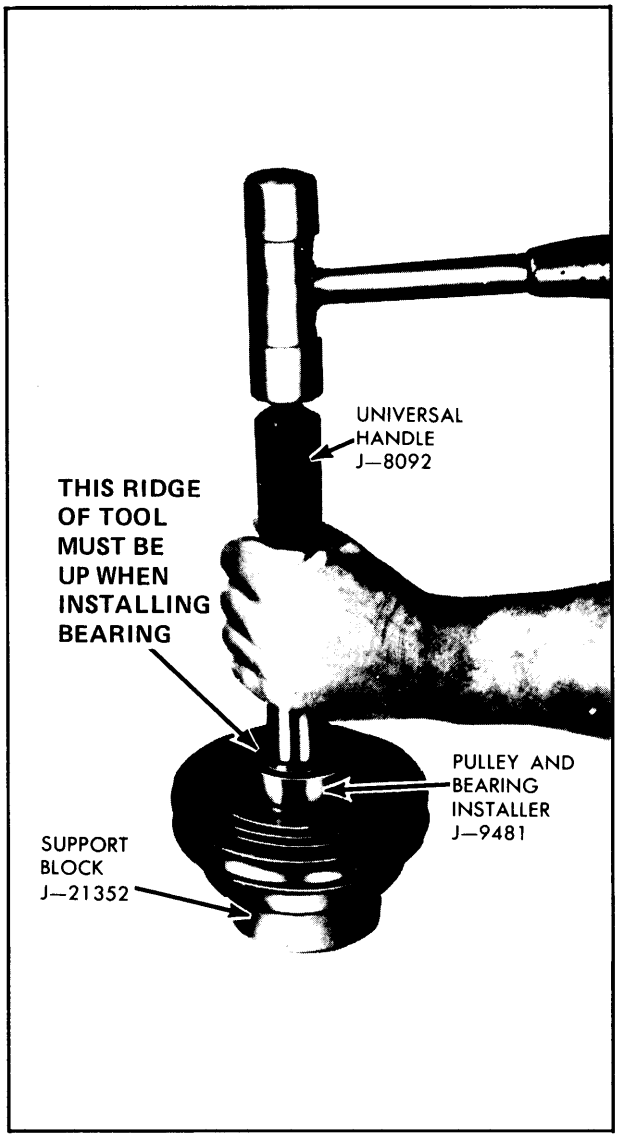


Fig. 1-74 Installing Bearing Onto Pulley

2. Align locating extrusions on coil housing with holes in front head casting.

3. Install coil housing retainer ring with flat side of ring facing coil, using Snap-Ring Pliers J-6435 (#26).

4. Install pulley and bearing assembly as described in Note 42b, "Compressor Pulley and Bearing Assembly" Replacement procedure.

5. Install clutch plate and hub assembly as described in Note 41b, "Compressor Clutch Plate and Hub Assembly" Replacement Procedure.

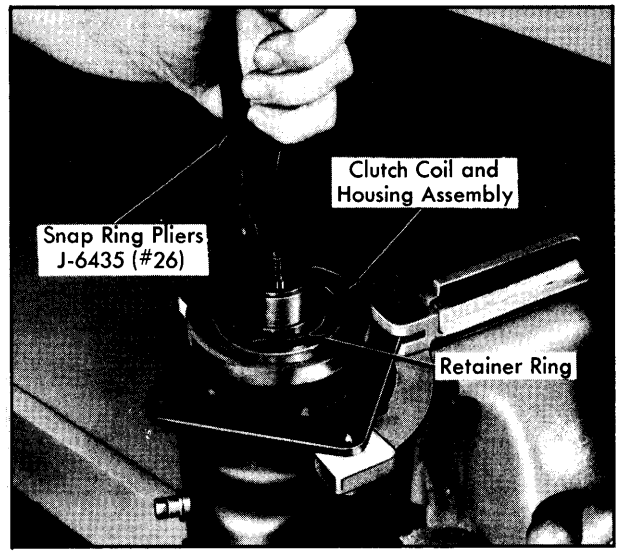


Fig. 1-75 Removing Coil Housing Retaining Ring

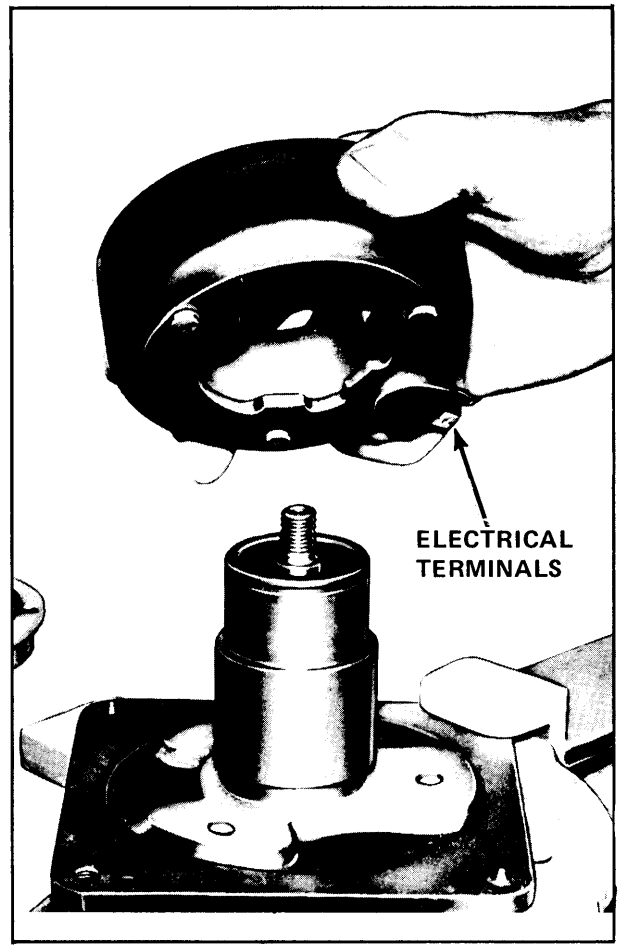


Fig. 1-76 Installing Coil Housing

BACK TO INDEX

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MAJOR COMPRESSOR REPAIR PROCEDURES

Service repair procedures to the Compressor Shaft Seal, Pressure Relief Valve and Superheat Switch, or disassembly of the Internal Compressor Mechanism are considered "MAJOR" SINCE THE REFRIGERATION SYSTEM MUST BE COMPLETELY PURGED OF REFRIGERANT before proceeding and/or because major internal operating and sealing components of the compressor are being disassembled and serviced.

A clean workbench, preferably covered with a sheet of clean paper, orderliness in the work area and a place for all parts being removed and replaced is of great importance, as is the use of the proper, clean service tools. Any attempt to use make-shift or inadequate equipment may result in damage and/or improper compressor operation.

These procedures are based on the use of the proper service tools and the condition than an adequate stock of service parts is available.

All parts required for servicing a compressor are protected by a preservation process and packaged in a manner which will eliminate the necessity of cleaning, washing or flushing of the parts. The parts can be used in the assembly just as they are removed from the service package.

Piston shoe discs and shaft thrust races will be identified by "number" on the parts themselves for reference to determine their size and dimension (Fig. 1-100).

45. Compressor Shaft Seal

a. Seal Leak Detection

A SHAFT SEAL SHOULD NOT BE CHANGED BECAUSE OF AN OIL-LINE ON THE HOOD INSULATOR. The seal is designed to seep some oil for lubrication purposes. Only change a shaft seal when a leak is detected by the following procedure.

When refrigerant system components other than the compressor are replaced, the compressor must be removed and oil drained from the compressor if oil was sprayed in large amounts due to leaks or a broken shaft seal.

Compressor shaft seals, unless replaced during a compressor overhaul, are to be replaced only on the basis of actual refrigerant leakage as determined by test with an electronic-type leak detector.

WHEN REPLACING THE SHAFT SEAL ASSEMBLY, even if the compressor remains on the vehicle during the operation, IT WILL BE NECESSARY TO PURGE THE SYSTEM OF REFRIGERANT as described in Note 12.

b. Removal

1. After first purging the system of refrigerant, remove the clutch plate and hub assembly and shaft key as described in Note 41a, "Compressor Clutch Plate and Hub Assembly" Removal procedure.

2. Pry out the sleeve retainer and remove the absorbent sleeve. Remove the shaft seal seat retaining ring using Snap-Ring Pliers J-5403 (#21) (Fig. 1-77).

3. Thoroughly clean inside of compressor neck area surrounding the shaft, the exposed portion of the seal seat and the shaft itself. This is absolutely necessary to prevent any dirt or foreign material from getting into compressor.

4. Place Seal Protector J-22974 over the end of the shaft to prevent chipping the ceramic seat. Fully engage the knurled tangs of Seal Seat Remover-Installer J-23128 into the recessed portion of the seal seat by turning the handle clockwise. Lift the seat from the compressor with a rotary motion (Fig. 1-78).

CAUTION: DO NOT tighten the handle with a wrench or pliers; however, the handle must be hand-tightened securely to remove the seat.

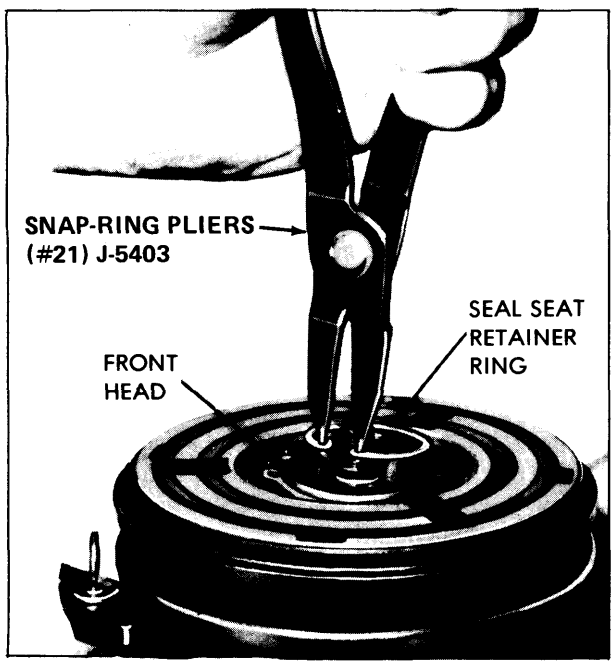


Fig. 1-77 Removing and Installing Shaft Seal Retaining Ring

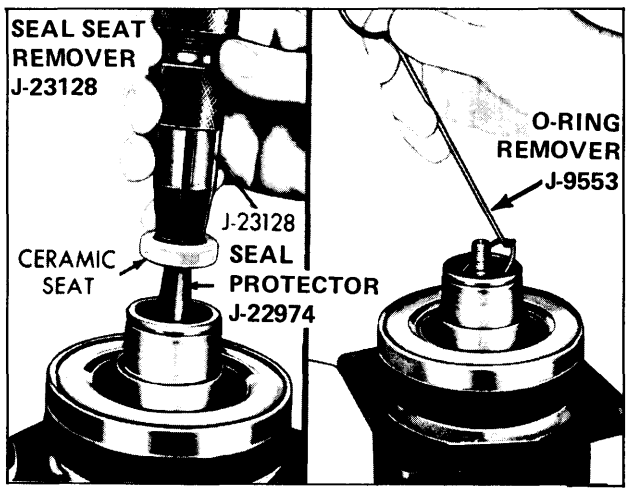


Fig. 1-78 Removing Shaft Seal Seat and O-Ring

BACK TO INDEX

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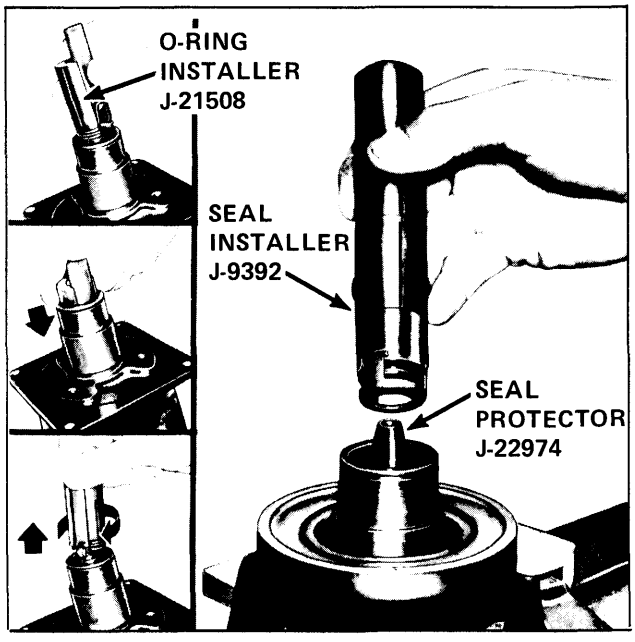


Fig. 1-79 Installing Shaft Seal and O-Ring

5. With Seal Protector J-22974 still over the end of the shaft, engage the tabs on the seal assembly with the tangs on Seal Installer J-9392 by twisting the tool clockwise, while pressing the tool down. Then lift the seal assembly out (Fig. 1-79).

6. Remove the seal seat O-ring from the compressor neck using O-ring Remover J-9533 (Fig. 1-78).

7. Recheck the shaft and inside of the compressor neck for dirt or neck foreign material and be sure these areas are perfectly clean before installing new parts.

c. Inspection

SEALS SHOULD NOT BE REUSED. ALWAYS USE A NEW SEAL KIT ON REBUILD. Be extremely careful

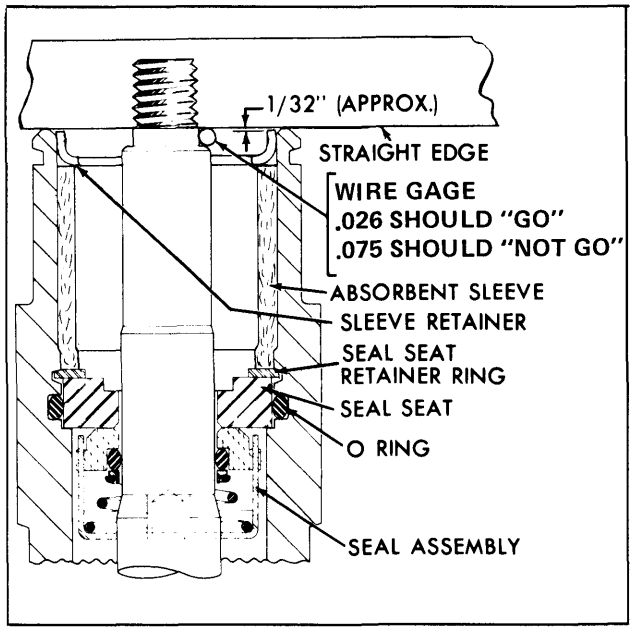


Fig. 1-80 Compressor Shaft and Seal

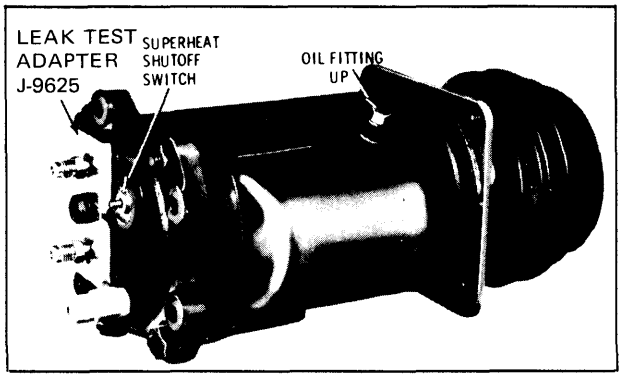


Fig. 1-81 Leak Testing Compressor

that the face of the seal to be installed is not scratched or damaged in any way. Make sure that the seal seat and seal are free of lint and dirt that could damage the seal surface or prevent sealing.

d. Installation

1. Coat new seal seat O-ring with clean 525 viscosity refrigerant oil and install in compressor neck, making certain it is installed in bottom groove (Fig. 1-79 and Fig. 1-80). Top groove is for retainer ring. Use O-ring Installer J-21508.

2. Coat the O-ring and seal face of the new seal assembly with clean 525 viscosity refrigerant oil. Carefully mount the seal assembly to Seal Installer J-9392 by engaging the tabs of the seal with the tangs of the tool (Fig. 1-79).

3. Place Seal Protector J-22974 (Fig. 1-79) over end of shaft and carefully slide the new seal assembly onto the shaft. Gently twist the tool CLOCKWISE, while pushing the seal assembly down the shaft until the seal assembly engages the flats on the shaft and is seated in place. Disengage the tool by pressing downward and twisting tool counterclockwise.

4. Coat the seal face of the new seal seat with clean 525 viscosity refrigerant oil. Mount the seal seat on Seal Seat Remover-Installer J-23128 and install it in the compressor neck, taking care not to dislodge the seal seat O-ring and being sure the seal seat makes a good seal with the O-ring. Remove Seal Protector J-22974 from the end of the shaft (see Fig. 1-78).

5. Install the new seal seat retainer ring with its flat side against the seal seat, using Snap-Ring Pliers J-5403 (#21) (Fig. 1-77). Use the sleeve from Seal Seat Remover-Installer J-23128 (Fig. 1-78) to press in on the seal seat retainer ring so that it snaps into its groove.

6. Install Compressor Leak Test Fixture J-9625 on rear head of compressor and connect gage charging lines as shown for bench test in Fig. 1-81 or pressurize SUCTION SIDE of compressor on car with Refrigerant-12 vapor to equalize pressure to the drum pressure. Temporatily install the shaft nut and, with compressor in horizontal position and oil sump down, rotate the compressor shaft in normal direction of rotation several times by hand. Leak test the seal with an electronic-type Leak Detector. Correct any leak found. Remove and discard the shaft nut.

7. Remove any excess oil, resulting from installing

BACK TO INDEX

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the new seal parts, from the shaft and inside the compressor neck.

8. Install the new absorbent sleeve by rolling the material into a cylinder, overlapping the ends, and then slipping the sleeve into the compressor neck with the overlap towards the top of the compressor. With a small screwdriver or similar instrument, carefully spread the sleeve until the ends of the sleeve butt at the top vertical centerline.

9. Position the new metal sleeve retainer so that its flange face will be against the front end of the sleeve. Pulley Puller Pilot J-9395 (Fig. 1-79) may be used to install the retainer. Press and tap with a mallet, setting the retainer and sleeve into place (retainer should be recessed approximately 1/32" from the face of the compressor neck) (Fig. 1-80).

10. Reinstall the clutch plate and hub assembly as described in Note 41b, "Compressor Clutch Plate and Hub Assembly" Replacement procedure.

Some compressor shaft seal leaks may be the result of mispositioning of the axial plate on the compressor shaft. The mispositioning of the axial plate may be caused by improper procedures used during pulley and driven plate removal, pounding, collisions or dropping the compressor. If the axial plate is mispositioned, the carbon face of the shaft seal assembly may not contact the seal seat and the rear thrust races and bearing may be damaged.

If there appears to be too much or insufficient air gap between the drive and driven plates, dislocation of the shaft should be suspected. If the ceramic seal is not seating against the seal seat, it will not be possible to completely evacuate the system as described in Note 12, "Evacuating the Refrigeration System."

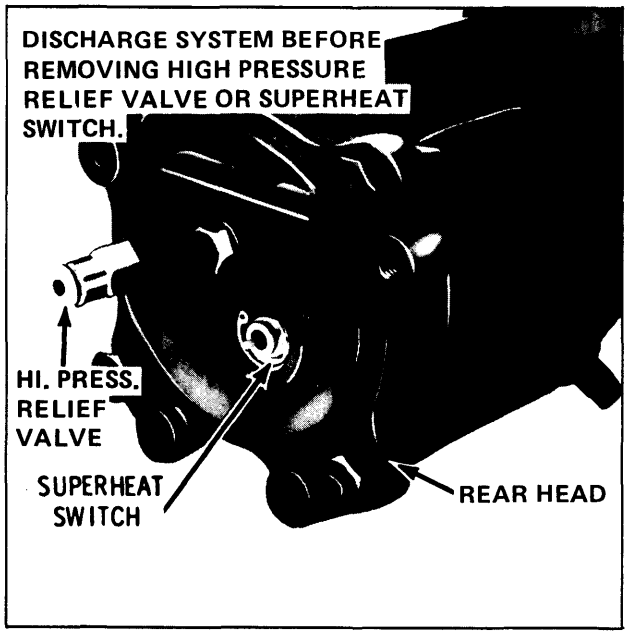


Fig. 1-82 High Pressure Relief Valve and Superheat Switch Locations

To check for proper positioning of the axial plate on the shaft, remove the clutch driven plate and measure the distance between the front head extension and the flat shoulder on the shaft as shown in Fig. 1-80. To measure this distance, use a wire gage (the clearance should be between .026" and .075"). If the shaft has been pushed back in the axial plate (measurement greater than .075"), disassemble the compressor and replace the shaft and axial plate assembly rear thrust race and thrust bearing.

11. Evacuate and charge system as described in Note 12, "Depressurizing Evacuating and Charging the Refrigeration System".

46. Compressor Pressure Relief Valve

When necessary to replace the pressure relief valve, located in the compressor rear head casting, the valve assembly should be removed after PURGING THE SYSTEM OF REFRIGERANT and a new valve and gasket installed. The entire system should then be "Evacuated and Recharged." (Fig. 1-82).

47. Compressor Superheat Switch

If it becomes necessary to replace the superheat switch, located in the compressor rear head casting, the switch assembly should be removed only after PURGING THE SYSTEM OF REFRIGERANT. After the switch has been replaced and a new O-ring seal installed, the system should be "Evacuated and Recharged" Fig. 1-82. See Note 39.

48. Compressor Internal Mechanism

Service operations to the rear head or internal mechanism of the compressor should be performed with the compressor removed from the vehicle to insure that the necessary degree of cleanliness may be maintained. Clean hands, clean tools and a clean bench, preferably covered with clean paper, are of extreme importance.

An inspection should be made of the internal mechanism assembly to determine if any service operations should be performed. A detailed inspection of parts should be made to determine if it is economically feasible to replace them.

a. Removal from External Housing

1. Before proceeding with disassembly, wipe exterior surface of compressor clean.

2. All oil in compressor should be drained and measured. Assist draining by positioning compressor with oil drain plug down. Record the amount of oil drained from the compressor.

3. Invert compressor and Holding Fixture J-9396 with front end of compressor shaft facing downward (Fig. 1-83).

Additional oil may leak from compressor at this time. All oil must be drained into a container so that TOTAL amount can be measured. A liquid measuring cup may be used for this purpose. Drained oil should then be discarded.

BACK TO INDEX

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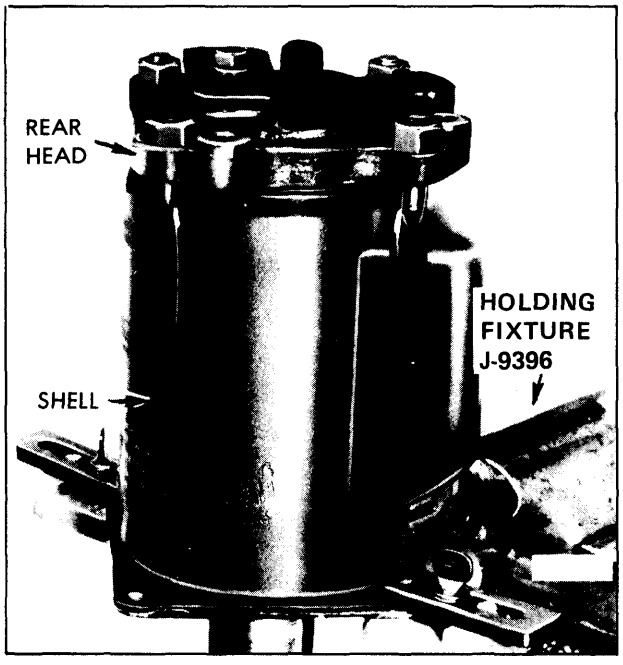


Fig. 1-83 Compressor Installed in Holding Fixture

4. Remove four locknuts from threaded studs on compressor shell and remove rear head. Tap uniformly around rear head if head is binding. (Fig. 1-83)

5. Wipe excess oil from all sealing surfaces on rear head casting webs, and examine sealing surfaces (Fig. 1-84). If any damage is observed, the head should be replaced.

6. Remove suction screen and examine for any damage or contamination. Clean or replace if necessary.

7. Paint an identifying mark on exposed face of inner and outer oil pump gears and then remove gears. Identifying marks are to assure that gears, if reused, will be installed on identical position.

8. Remove and discard rear head to shell O-ring.

9. Carefully remove rear discharge valve plate assembly. Use two small screwdrivers under reed

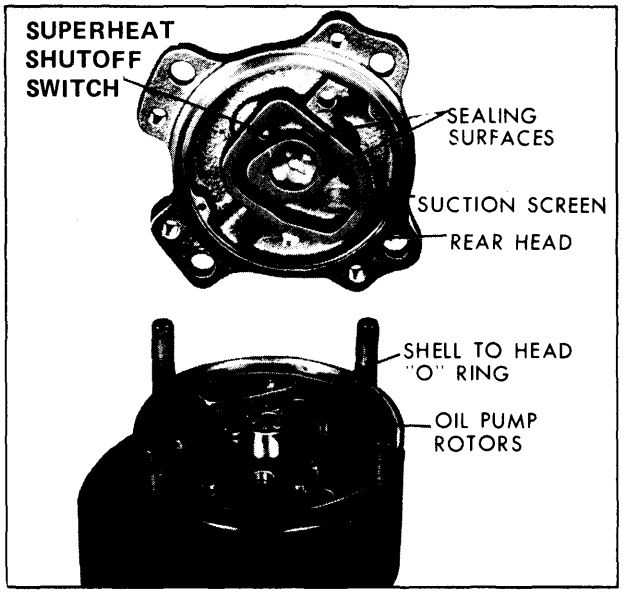


Fig. 1-84 Removing Rear Head

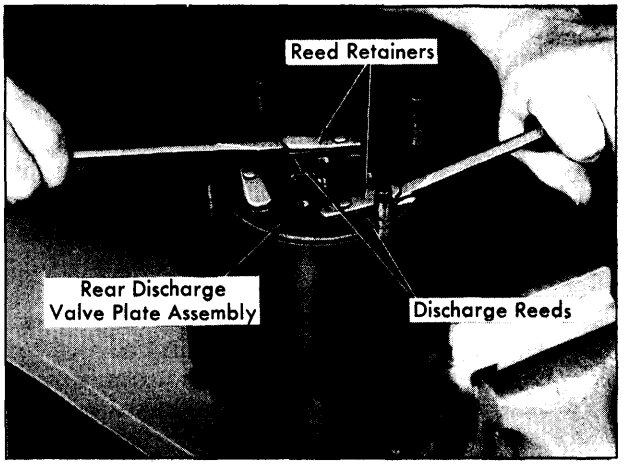


Fig. 1-85 Removing Rear Discharge Valve Plate

retainers to pry up on assembly (Fig. 1-85). Do not position screwdrivers between reeds and reed seats.

10. Examine valve reeds and seats. Replace entire assembly if any reeds or seats are damaged.

11. Using two small screwdrivers, carefully remove rear suction reed (Fig. 1-86). Do not pry up on horseshoe-shaped reed valves.

12. Examine reeds for damage, and replace if necessary.

13. Using Oil Pick-Up Tube Remover J-5139 (Fig. 1-87), remove oil pick-up tube. Remove O-ring from oil inlet.

14. Loosen compressor from Holding Fixture J-9396, place Internal Assembly Support Block J-21352 over oil pump end of shaft and, holding Support Block in position with one hand, lift compressor from Holding Fixture with other hand. Invert compressor and position on bench with Internal Assembly Support Block resting on bench.

15. Lift front head and compressor shell assembly up, leaving internal mechanism resting on Internal Assembly Support Block.

CAUTION: To prevent damage to shaft, DO NOT TAP ON END OF COMPRESSOR SHAFT to remove internal mechanism. If mechanism will not slide out of compressor shell, tap on front head with a plastic hammer,

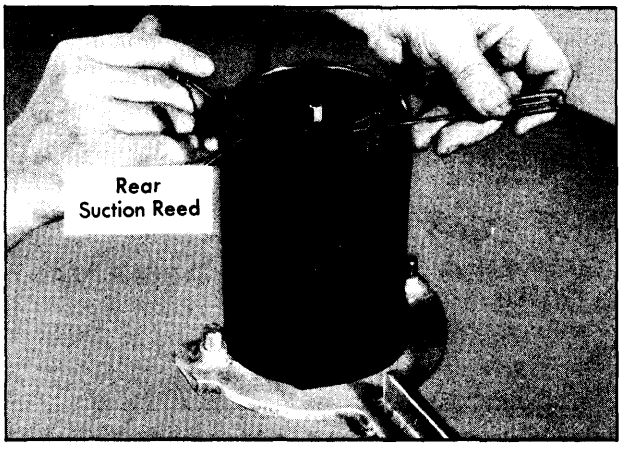


Fig. 1-86 Removing Rear Suction Reed

BACK TO INDEX

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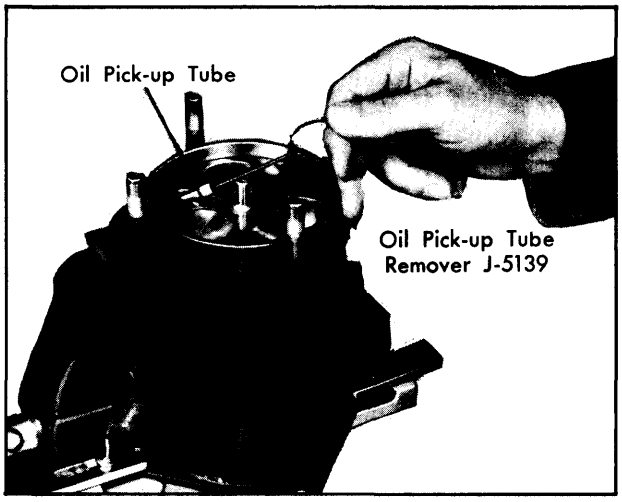


Fig. 1-87 Removing Oil Pick-Up Tube

16. Rest compressor shell on its side and push front head assembly through compressor shell, being careful not to damage sealing areas on inner side of front head. Discard O-ring.

It may be necessary to tap on outside of front head, using a plastic hammer, to overcome friction of O-ring seal between front head and compressor shell.

17. Wipe excess oil from sealing surfaces on front head casting webs and examine sealing surface. If any surface damage is observed, the head should be replaced.

18. Remove front discharge valve plate assembly and front suction reed plate. Examine reeds and seats. Replace necessary parts.

19. Remove suction crossover cover by prying with screwdriver between cylinder casting and cover (Fig. 1-88).

20. Examine internal mechanism for any obvious damage, If internal mechanism has sustained major damage, due to loss of refrigerant or oil, it may be necessary to replace the complete internal mechanism Assembly rather than replace individual parts.

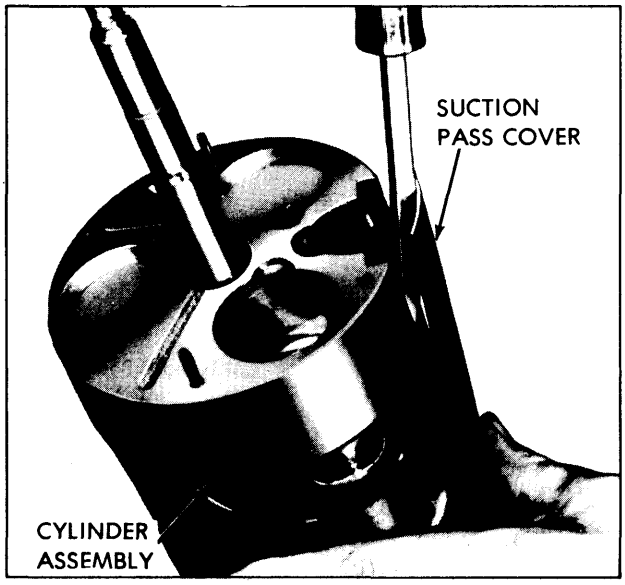


Fig. 1-88 Removing Suction Crossover Cover

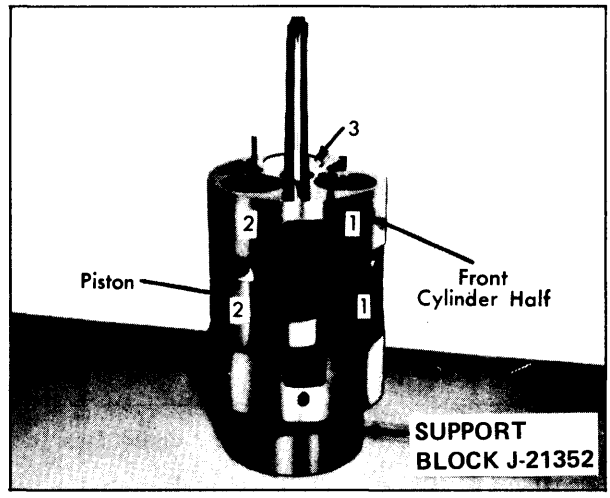


Fig. 1-89 Numbering Piston and Cylinder Bores

b. Disassembly

Use Parts Tray J-9402 (Fig. 1-92) to retain compressor parts during disassembly.

1. Remove internal mechanism from compressor as described in Note 48a, "Compressor Internal Mechanism" Removal procedure.

2. Identify by pencil mark, or some other suitable means, each piston numbering them as 1, 2, and 3 (fig. 1-89).

Number the piston bores in the front cylinder half in like manner, so that pistons can be replaced in their original locations.

3. Separate cylinder halves, using a wood block and mallet (Fig. 1-90). Make certain that discharge cross-over tube does not contact axial plate when separating cylinder halves (a new Service discharge cross-over tube will be installed later).

CAUTION: UNDER NO CIRCUMSTANCES SHOULD SHAFT BE STRUCK AT EITHER END in an effort to separate upper and lower cylinder halves because the shaft and the axial plate could be damaged.

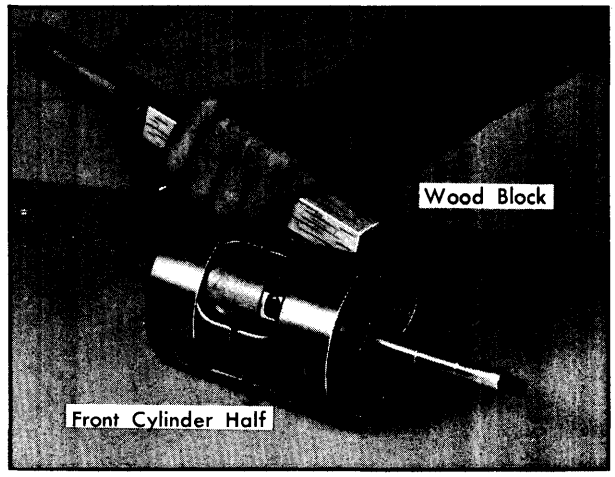


Fig. 1-90 Separating Cylinder Halves

BACK TO INDEX

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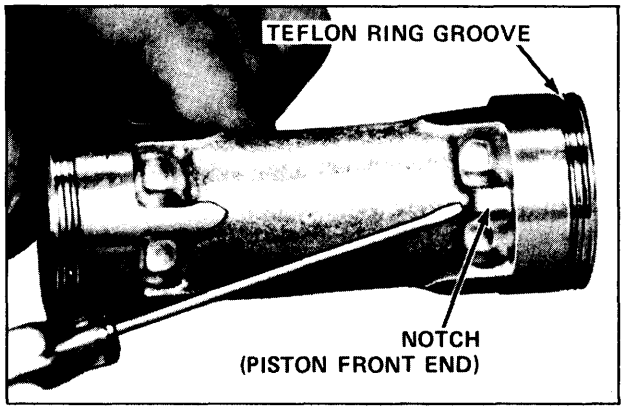


Fig. 1-91 Notch Identifying Front End of Piston

4. Carefully remove the rear half of the cylinder from the pistons and set the front cylinder half, with the piston, shaft and axial plate in Compressing Fixture J-9397.

5. Pull up on compressor shaft and remove piston previously identified as No. 1, with balls and shoe discs, from axial plate.

a. Inspect the Teflon piston rings for nicks, cuts or metal particles imbedded in exposed ring surface and replace the piston rings as required if either condition exists. See Note 49, "Teflon Piston Ring" Replacement procedure.

6. Remove and discard the piston shoe discs.

7. Remove and examine piston balls, and if satisfactory for re-use, place balls in No. 1 compartment of Parts Tray J-9402 (Fig. 1-92).

8. Place piston in No. 1 compartment of Parts Tray J-9402, with notch in casting web at front end of piston (Fig. 1-91) into the dimpled groove of Parts Tray compartment.

9. Repeat Steps 5 through 9 for Pistons No. 2 and No. 3.

10. Remove rear combination of thrust races and thrust bearing from shaft. Discard races and bearing.

11. Remove shaft assembly from front cylinder half. If the discharge cross-over tube remained in the front cylinder half, it may be necessary to bend discharge cross-over tube slightly in order to remove shaft.

12. Remove front combination of thrust races and bearing from shaft. Discard races and bearing.

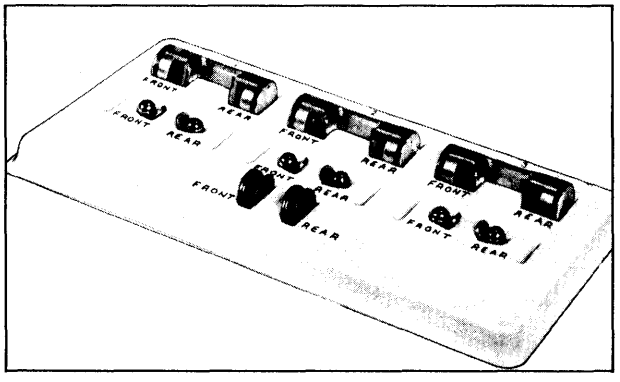


Fig. 1-92 Parts Tray

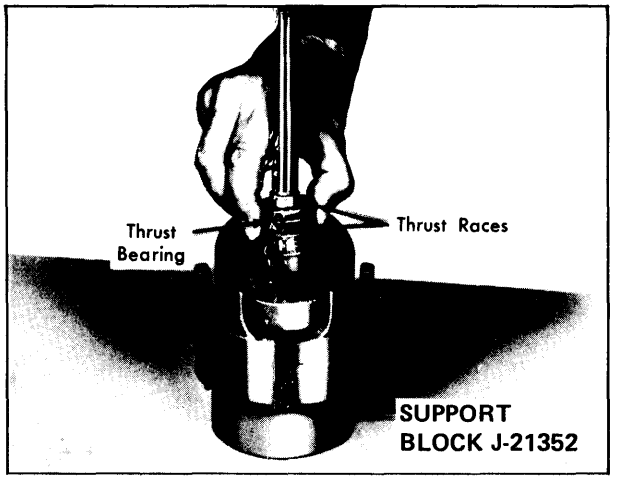


Fig. 1-93 Removing Front Thrust Races and Bearings

13. Examine surface of axial plate and shaft. Replace as an assembly, if necessary.

A certain amount of shoe disc wear on axial plate is normal, as well as some markings indicating load of needle bearings on shaft.

14. Remove discharge cross-over tube from cylinder half, using self-clamping pliers.

This is necessary only on original factory equipment, as ends of the tube are swedged into cylinder halves. The discharge cross-over tube in internal mechanism assemblies that have been previously serviced have an O-ring and bushing at EACH END of the tube, and can be easily removed by hand (Fig. 1-112).

15. Examine piston bores and needle bearings in front and rear cylinder halves. Replace front and rear cylinders if any cylinder bore is deeply scored or damaged.

16. Needle bearings may be removed if necessary by driving them out with special Thin-Wall Socket J-9399. Insert socket in hub end (inner side) of cylinder head and drive bearing out. To install needle bearing, place cylinder half on Support Block J-21352, and insert bearing in end of cylinder head with bearing

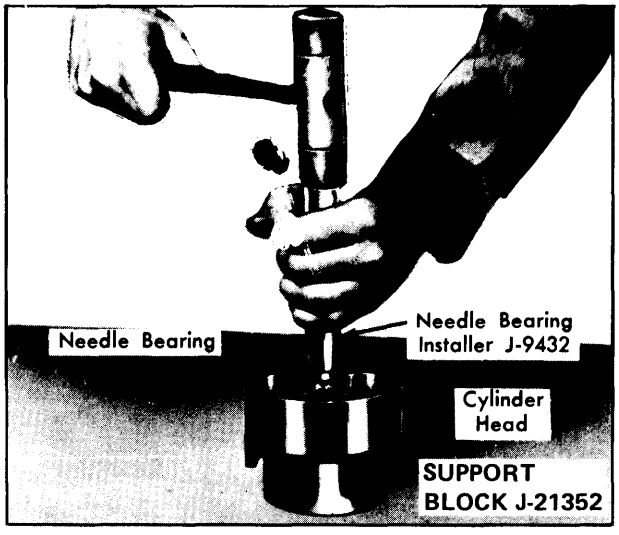


Fig. 1-94 Installing Needle Bearing

BACK TO INDEX

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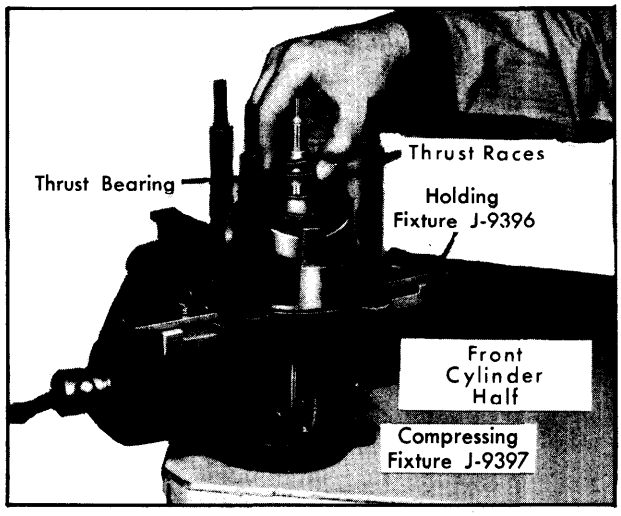


Fig. 1-95 Installing Rear Thrust Races and Bearings

identification marks UP. Use Needle Bearing Installer J-9432 and drive bearing into cylinder head (Fig. 1-94), until tool bottoms on the cylinder face.

Two different width needle bearings are used in Production compressors - a 1/2" size and a 5/8" size. The bearings ARE interchangeable. Service replacement bearings are all 1/2".

17. Wash all parts to be re-used with trichlorethylene, naphtha, stoddard, kerosene, (in that order of preference) or a similar solvent. Air-dry parts using a source of clean, dry air.

Compressor internal components may be identified by referring to Fig. 1-59 and Fig. 1-60.

c. Gaging Operation

1. Install Compressing Fixture J-9397 on Holding Fixture J-9396 in vise. Place front cylinder half in Compressing Fixture, flat side down. Front cylinder half has long slot extending out from shaft hole.

2. Secure from Service parts stock four ZERO thrust races and three ZERO shoe discs.

3. Install a ZERO thrust race, thrust bearing, and a second ZERO thrust race on front end of compressor shaft. Lubricate races and bearing with petrolatum.

4. Insert threaded end of shaft through needle

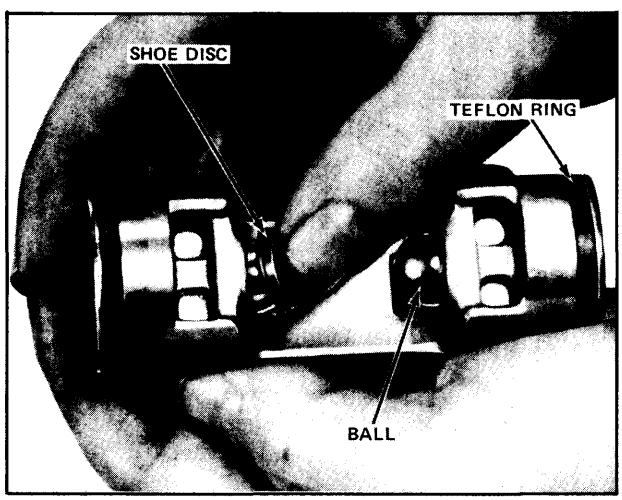


Fig. 1-96 Installing Front Shoe Disc

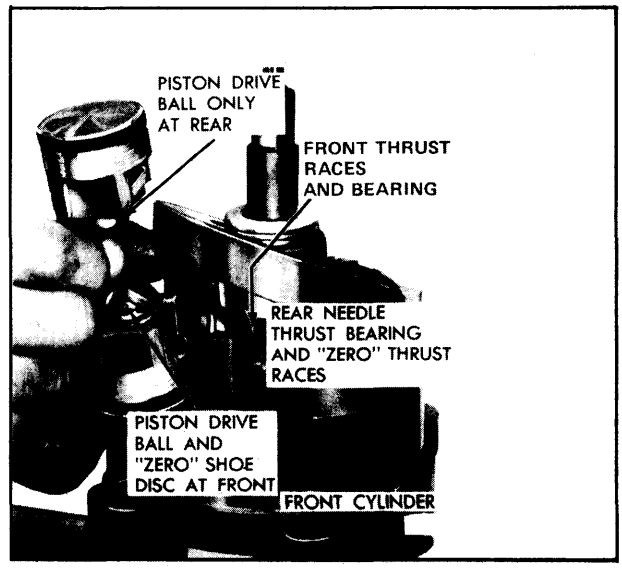


Fig. 1-97 Installing Piston During Gaging Operation

bearing in front cylinder half, and allow thrust race and bearing assembly to rest on hub of cylinder.

5. Now install a ZERO thrust race on rear end of compressor shaft (Fig. 1-95), so that it rests on hub of axial plate. Then install thrust bearing and a second ZERO thrust race. Lubricate races and bearing with petrolatum.

6. Lubricate ball pockets of the No. 1 Piston with 525 viscosity refrigerant oil and place a ball in each socket. Use balls previously removed if they are to be re-used.

7. Lubricate cavity of a ZERO shoe disc with 525 viscosity refrigerant oil and place shoe disc over ball in front end of piston (Fig. 1-96). Front end of piston has an identifying notch in casting web (Fig. 1-91).

CAUTION: Exercise care in handling the Piston and Ring Assembly, particularly during assembly into and removal from the cylinder bores to prevent damage to the Teflon piston rings.

Shoe discs should not be installed on rear of piston during following "Gaging" operation.

8. Rotate shaft and axial plate until high point of axial plate is over the No. 1 Piston cylinder bore.

9. Lift shaft assembly up and hold front thrust race and bearing assembly against axial plate hub.

10. Position piston over No. 1 cylinder bore (notched end of piston being on bottom and piston straddling axial plate) and lower the shaft to allow piston to drop into its bore (Fig. 1-97).

11. Repeat Steps 6 through 10 for Pistons No. 2 and No. 3.

12. Install rear cylinder half on pistons, aligning cylinder with discharge cross-over tube hole in front cylinder. Tap into place using a plastic mallet or piece of clean wood and hammer (Fig. 1-98).

13. Position discharge cross-over tube opening between a pair of Compressing Fixture bolts to permit access for feeler gage.

14. Install top plate on Compressing Fixture J-9397.

BACK TO INDEX

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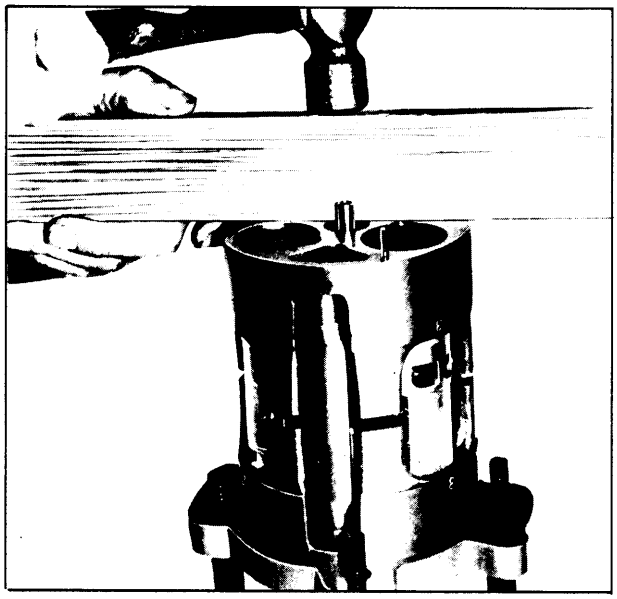


Fig. 1-98 Assembling Cylinder Halves

Tighten nuts to 15 lb. ft. torque using a 0-25 lb. ft. torque wrench.

d. Gaging Procedure (Steps 15 thru 18)

The gaging operations which follow have been worked out on a simple basis to establish and provide necessary running tolerances. Two gaging procedures are necessary.

The first is made to choose the proper size shoe discs to provide, at each piston, a .0016" to .0024" total preload between the seats and the axial plate at the tightest place through the 360-degree rotation of the axial plate at the tightest plate. The bronze shoe discs are provided in .0005" variations, including a basic ZERO shoe.

The second, performed at the rear shaft thrust bearing and race pack, is designed to obtain .0025" to .0030" preload between the hub surfaces of the axial plate and the front and rear hubs of the cylinder. A total of 14 steel thrust races, including a basic ZERO race, are provided in increments of .0005" thickness to provide the required fit.

Feeler Gage Set J-9564 or J-9661-01 may be used for gaging proper shoe disc size. Feeler Gage Set J-9564-01 or Dial Indicator Set J-8001-3 may be used to determine proper thrust race size.

PROPER SELECTION OF THRUST RACES AND BALL SEATS IS OF EXTREME IMPORTANCE.

15. Measure clearance between rear ball of No. 1 Piston and axial plate, in following manner:

a. Select a suitable combination of well-oiled Feeler Gage leaves to fit snugly between ball and axial plate.

b. Attach a spring scale, reading in 1-ounce increments, to the feeler gage. A distributor point checking scale may be used.

c. Pull on Spring Scale to slide Feeler Gage stock out from between ball and axial plate, and note reading on Spring Scale as Feeler Gage is removed (Fig. 1-99). Reading should be between 4 and 8 ounces.

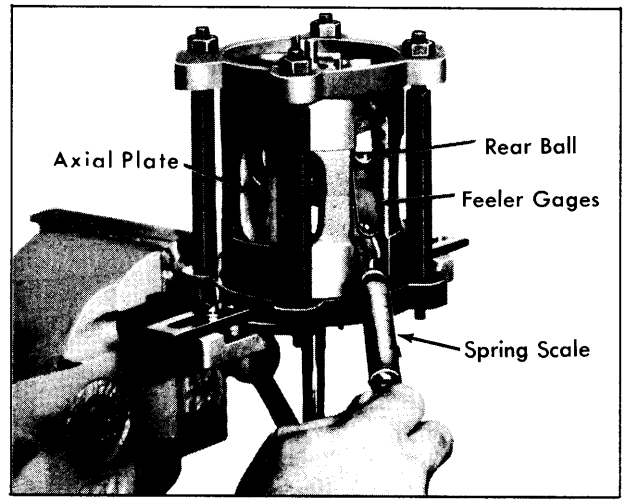


Fig. 1-99 Gaging Rear Piston Ball

d. If reading in Step c. above is under 4 OR over 8 ounces, reduce or increase thickness of Feeler Gage leaves and repeat Steps a. through c. above until a reading of 4 to 8 ounces is obtained. Record clearance between ball and axial plate that results in the 4 to 8-ounce pull on Spring Scale.

16. Now rotate shaft 120° and repeat Step 15 between same ball and axial plate. Record this measurement.

If shaft is hard to rotate, install shaft nut onto shaft and turn shaft with wrench.

17. Rotate shaft another 120° and again repeat Step 15 between these same parts and record measurements.

Select a "numbered" shoe disc corresponding to minimize feeler gage reading recorded in the three checks above. (See example in Fig. 1-101). Place shoe discs in Parts Tray J-9402 compartment corresponding to Piston No. 1 and rear ball pocket position.

Shoe discs are provided in .0005" (one-half thousandths) variations. There are a total of 11 sizes available for field servicing. All shoe discs are marked with the shoe size, which corresponds to the last three digits of the piece part number. (See Shoe Disc size Chart in Fig. 1-100 above.)

Once a proper selection of the shoe has been made, THE MATCHED COMBINATION OF SHOE DISC TO REAR BALL AND SPHERICAL CAVITY IN PISTON MUST BE KEPT IN PROPER RELATIONSHIP during disassembly after gaging operation, and during final assembly of internal mechanism.

19. Repeat in detail the same gaging procedure outlined in Steps 15 through 18 for Piston No. 2 and No. 3.

20. Mount Dial Indicator J-8001-3 on edge of Compressing Fixture J-9397 with Clamp J-8001-1 and Sleeve J-8001-2 (Fig. 1-102). Position Dial Indicator on rear end of shaft and adjust to "zero".

Apply full hand-force at end of mainshaft a few times before reading clearance. This will help squeeze the oil out from/between mating parts. Push upward and record measurement. Dial Indicator increments are 001"; therefore, reading must be estimated to nearest .0005".

An alternate method of selecting a proper race is to

BACK TO INDEX

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SHOE DISC			THRUST BEARING RACE		
PART NO. ENDING IN	IDENTIFICATION STAMP	MIN. FEELER GAGE READING	PART NO. ENDING IN	IDENTIFICATION STAMP	DIAL INDICATOR READING
000	0	.0000	000	0	.0000
175	17-1/2	.0175	050	5	.0050
180	18	.0180	055	5-1/2	.0055
185	18-1/2	.0185	060	6	.0060
190	19	.0190	065	6-1/2	.0065
195	19-1/2	.0195	070	7	.0070
200	20	.0200	075	7-1/2	.0075
205	20-1/2	.0205	080	8	.0080
210	21	.0210	085	8-1/2	.0085
215	21-1/2	.0215	090	9	.0090
220	22	.0220	095	9-1/2	.0095
			100	10	.0100
			105	10-1/2	.0105
			110	11	.0110
			115	11-1/2	.0115
			120	12	.0120

Fig. 1-100 Available Service Shoes and Thrust Races

use Gage Set J-9661-01, selecting a suitable feeler gage leaf until the result is a 4 to 8 ounce pull on the scale between the rear thrust bearing and upper (or outer rear) thrust race (Fig. 1-103). If the pull is just less than 4 ounces, add .0005" to the thickness of the feeler stock used to measure the clearance. If the pull on the scale reads just over 8 ounces, then subtract .0005" from the thickness of the feeler stock. Select a race TWO (2) FULL SIZES LARGER than feeler gage thickness (If feeler gage is .007", select a No. 9 or 090 race).

21. Select a thrust race with a "number" corresponding to TWO (2) FULL SIZES LARGER than Dial Indicator or feeler gage measurement of the amount of end play shown. (If measurement is .007", select a No. 9 or 090 race). Place thrust race in right-hand slot at bottom center of Parts Tray J-9402.

Fifteen (15) thrust races are provided in increments of .0005" (one-half thousandths) thickness and one ZERO gage thickness, providing a total of 16 sizes available for service. Thrust races are identified on the part by their thickness in thousandths, in excess of the thickness of the ZERO thrust race.

This "number" also corresponds to the last three digits of the piece part number. See Thrust Race size Chart in Fig. 1-100.

	POSITION 1	POSITION 2	POSITION 3	SELECT AND USE SHOE NO.
PISTON NO. 1	.019"	.0195"	.019"	19
PISTON NO. 2	.020"	.020"	.020"	20
PISTON NO. 3	.021"	.021"	.022"	21

Fig. 1-101 Selection of Correct Shoe Disc

22. Remove nuts from top plate of Compressing Fixture J-9397, and remove top plate.

23. Separate cylinder halves while unit is in Fixture. It may be necessary to use a wood block and mallet.

24. Remove rear cylinder half and carefully remove one piston at a time from axial plate and front cylinder half. DO NOT LOSE THE RELATIONSHIP of the front ball and shoe disc and rear ball. Transfer each piston, ball, and shoe disc to its proper place in Parts Tray J-9402.

25. Remove rear outer ZERO thrust race from shaft and install thrust race just selected.

The ZERO thrust race may be put aside for re-use in additional gaging or rebuilding operations.

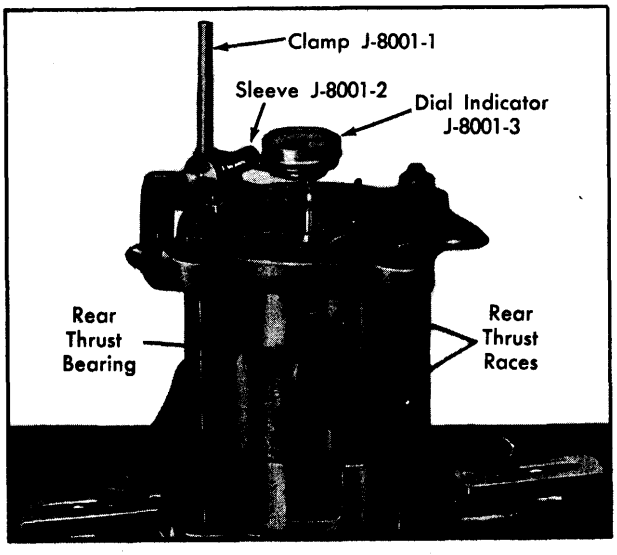


Fig. 1-102 Gaging Rear Thrust Race

BACK TO INDEX

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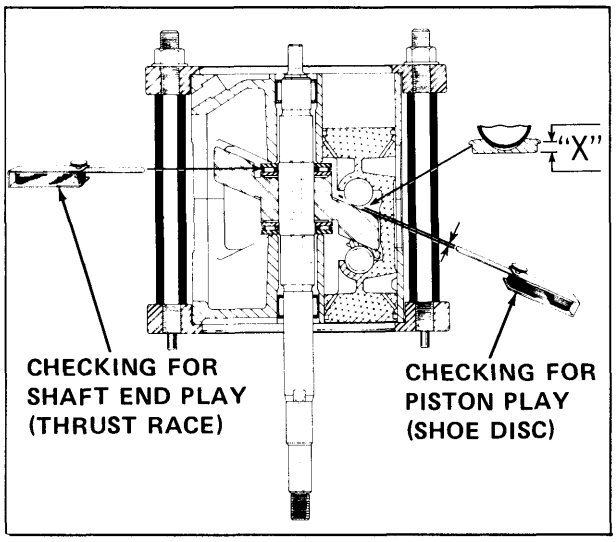


Fig. 1-103 Checking Piston and Shaft End Play

49. Teflon Piston Ring Replacement

The Teflon piston ring installing, sizing and gaging tools are shown in Fig. 1-104.

1. Remove the old piston rings by CAREFULLY slicing through the ring with a knife or sharp instrument, holding the blade almost flat with the piston surface. Be careful not to damage the aluminum piston OR piston groove in cutting to remove the ring.

Exercise personal care in cutting the piston ring for removal.

2. Clean the piston and piston ring grooves with a recommended cleaning solvent and blow the piston dry with dry air (Trichlorethylene, naphtha, stoddard solvent, kerosene, or equivalent in order of preference).

3. Set the piston on end on a clean, flat surface and install the Ring Installer Guide J-24608-2 on the end of the piston (Fig. 1-105).

4. Install a Teflon ring on the Ring Installer Guide J-24605-2 as shown in Fig. 1-105, with the dished or dull-side down and glossy-side up.

5. Push the Ring Installer J-24608-5 down over the Installer Guide J-24608-2 to install the Teflon ring in the piston ring groove (Fig. 1-106). If the Teflon ring is slightly off position in the ring groove, it can be positioned into place by fingernail or blunt-edged tool that will not damage the piston.

The Ring Installer J-24608-5 will retain the Installer Guide J-24608-2 internally when the Teflon ring is installed on the piston. Remove the Installer Guide from the Ring Installer and DO NOT STORE THE INSTALLER GUIDE IN THE RING INSTALLER, as the Ring Installer Segment Retainer O-Ring J-24608-3 will be stretched and possibly weakened during storage. This could result in the O-Ring J-24608-3 not holding the Ring Installer segments tight enough to the Installer Guide J-24608-2 to properly install the Teflon ring on the piston.

6. Lubricate the piston ring area with 525 viscosity refrigerant oil and rotate the Piston and Ring Assembly into the Ring Sizer J-24608-6 at a slight angle (Fig. 1-108). Rotate the piston, while pushing inward, until the piston is inserted against the center stop of the Ring Sizer J-23608-6.

CAUTION: DO NOT push the Piston and Ring Assembly into the Ring Sizer J-24608-6 without proper positioning and rotating as described above, as the ends of the needle bearings of the Ring Sizer may damage the end of the piston.

7. Rotate the Piston and Ring Assembly in the Ring Sizer J-24608-6 several COMPLETE turns, until the Assembly rotates relatively free in the Ring Sizer (Fig. 1-108).

8. Remove the Piston and Ring assembly, wipe the end of the piston and ring area with a clean cloth and then push the Piston and Ring Assembly into the Ring Gage J-24608-1 (Fig. 1-109). The piston should go through the Ring Gage with a 6-lb. force or less without lubrication. If not, repeat Steps 6 and 7.

9. Repeat the procedure for the opposite end of the piston.

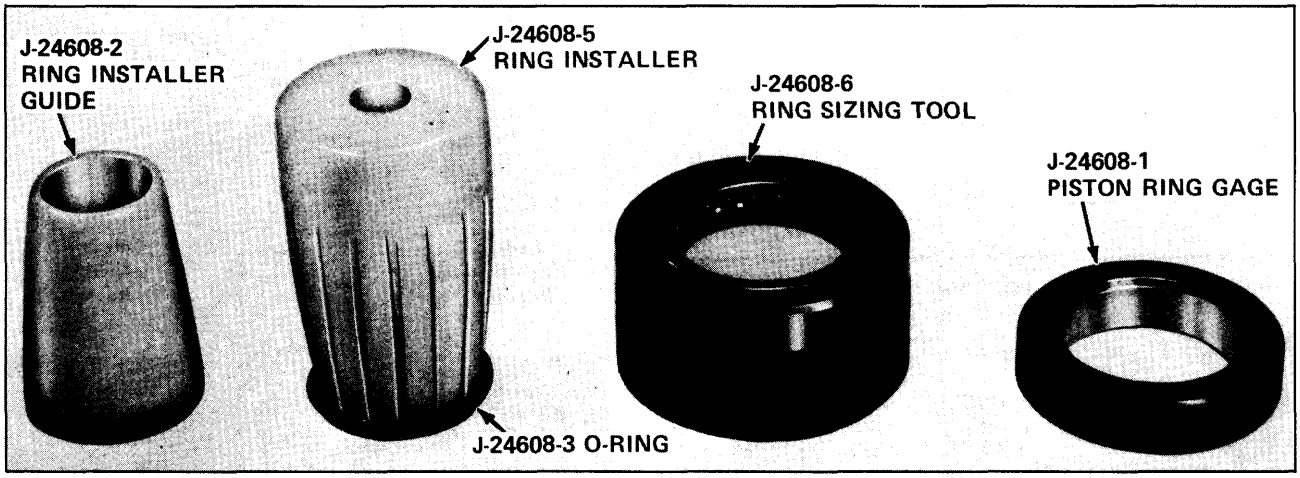


Fig. 1-104 Teflon Piston Ring Installing, Sizing and Gaging Tools

BACK TO INDEX

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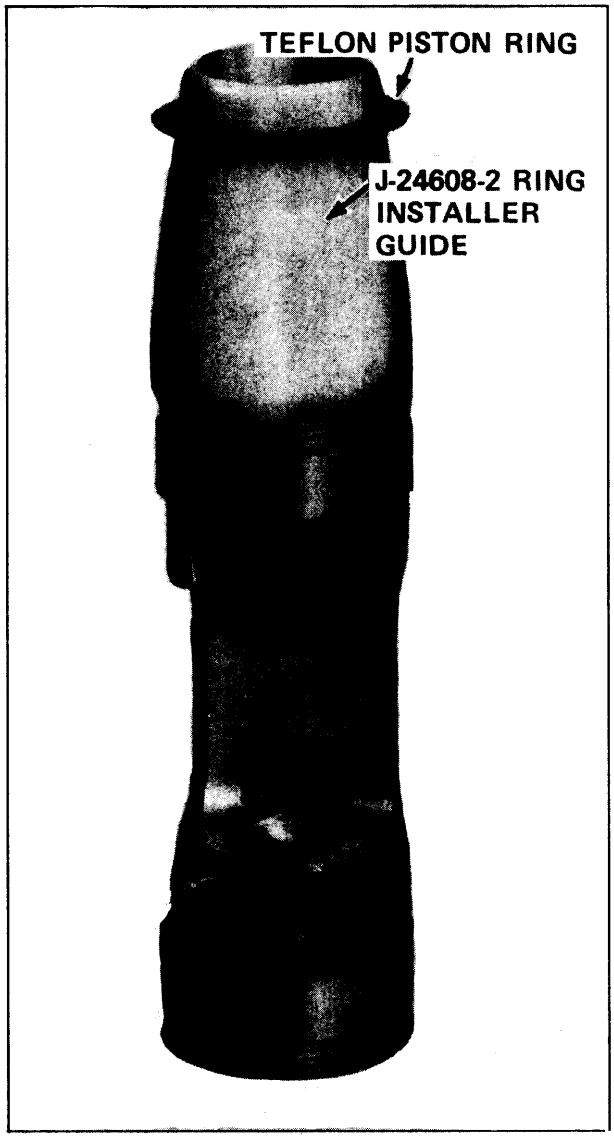


Fig. 1-105 Teflon Piston Ring Positioned on Ring Installer Guide

CAUTION: DO NOT lay the piston down on a dirty surface where dirt or metal chips might become imbedded in the Teflon ring surface.

10. Lubricate BOTH ENDS of the piston with 525 viscosity refrigerant oil before inserting the piston into the cylinder bore.

CAUTION: Reasonable care should be exercised in installing the piston into the cylinder bore to prevent damage to the Teflon ring.

50. Compressor-Assembly Procedure

(NOTE: After properly performing the "Gaging Procedure", choosing the correct shoe discs and thrust races, and installing any needed Teflon Piston Rings, the cylinder assembly may now be reassembled. Be sure to install all NEW seals and O-rings. All are included in the compressor O-Ring Service Kit.)

1. Support the FRONT half of the cylinder assembly on Compressing Fixture J-9397. Install the shaft and axial plate, threaded end down, with its front bearing race pack (ZERO race, bearing NUMBERED race), if this was not already done at the end of the "Gaging Procedure".

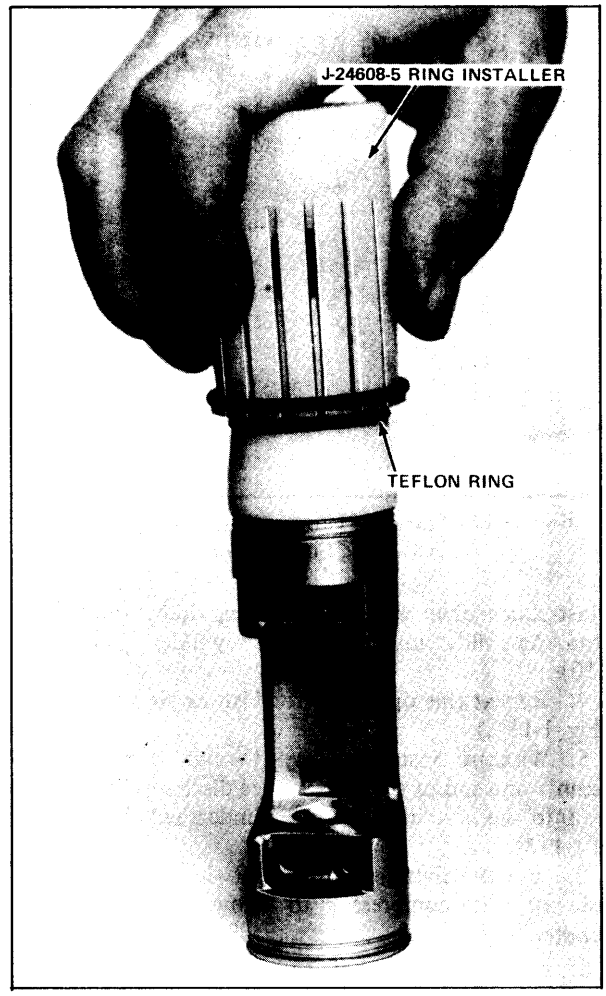


Fig. 1-106 Installing Teflon Piston Ring

2. Apply a light smear of petroleum jelly to the "numbered" shoe discs chosen in the gaging procedure and install all balls and shoe discs in their proper place in the piston assembly.

3. Rotate the axial plate so that the high point is above cylinder bore No. 1. Carefully assemble Piston No. 1, complete with ball and ZERO shoe disc on the front AND ball and NUMBERED shoe disc on the rear, over the axial plate. Hold front thrust bearing pack tightly

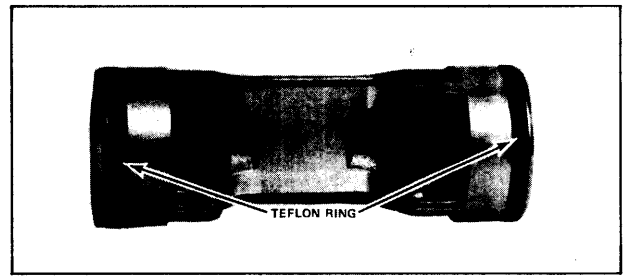


Fig. 1-107 Teflon Piston Ring Installed in Piston Groove

BACK TO INDEX

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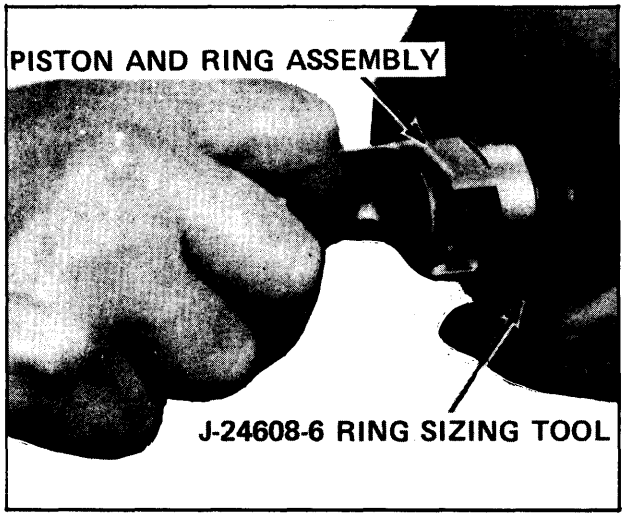


Fig. 1-108 Turning Piston and Ring Assembly into Ring Sizing Tool

against axial plate hub while lifting hub. Insert the Piston Assembly into the front cylinder half (Fig. 1-110).

4. Repeat this operation for Pistons No. 2 and No. 3 (Fig. 1-111.)

5. Without installing any O-rings or bushings, assemble one end of the new Service discharge cross-over tube into the hole in the front cylinder half (Fig. 1-112 and 1-113).

Be sure the flattened portion of this tube faces the inside of the compressor to allow for axial plate clearance (Fig. 1-113).

6. Now rotate the shaft to position the pistons in a stair-step arrangement; then carefully place the rear cylinder half over the shaft and start the pistons into the cylinder bores (Fig. 1-114).

7. When all three Piston and Ring Assemblies are in their respective cylinders, align the end of the discharge cross-over tube with the hole in the rear half of the cylinder.

8. When all parts are in proper alignment, tap with a clean wood block and mallet to seat the rear half of the cylinder over the locating dowel pins. If necessary, clamp the cylinder in Compressing Fixture J-9397, to complete drawing the cylinder halves together.

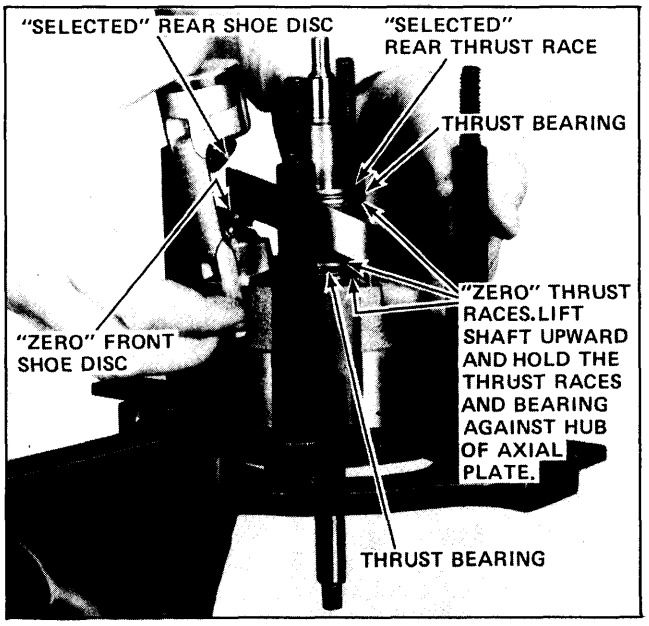


Fig. 1-110 Installing 1st Piston Assembly Into Front Cylinder Half

9. Generously lubricate all moving parts with clean 525 viscosity refrigerant oil and check for free rotation of the parts.

10. Replace the suction cross-over cover (Fig. 1-115). Compress the cover as shown to start it into the slot, and then press or carefully tap it in until flush on both ends.

51. Compressor Internal Mechanism

1. Place internal mechanism on Internal Assembly Support Block J-21352, with rear end of shaft in block hole.

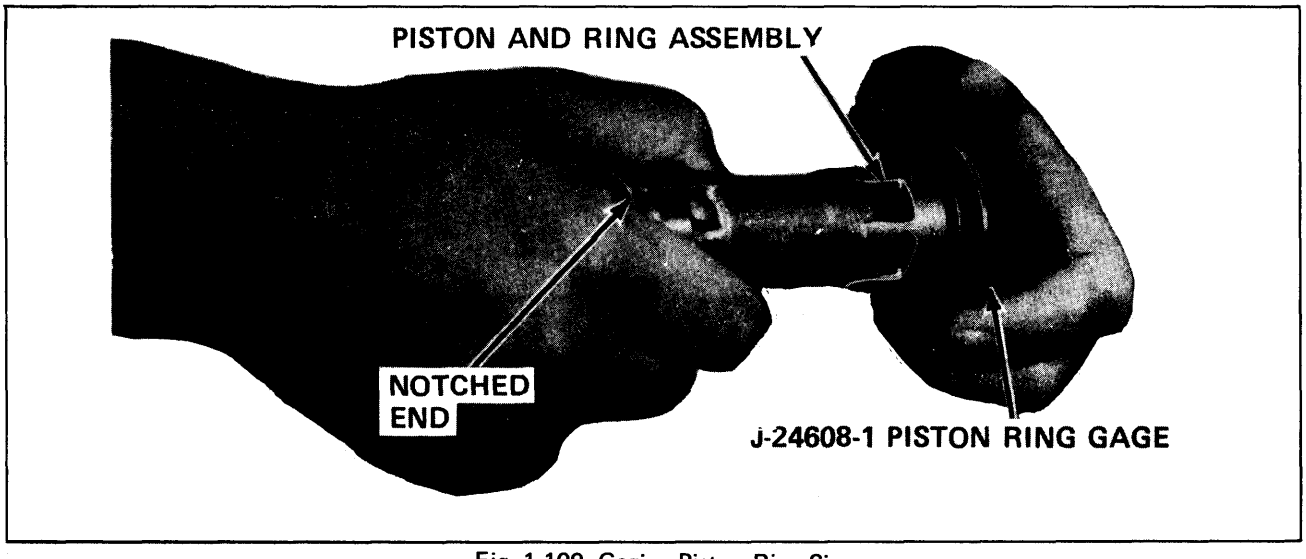


Fig. 1-109 Gaging Piston Ring Size

BACK TO INDEX

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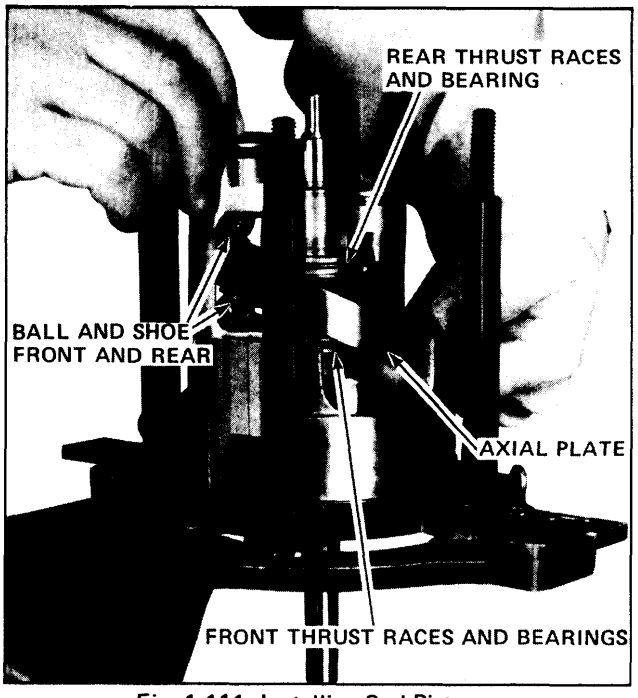


Fig. 1-111 Installing 2nd Piston

2. Now install new O-ring and bushing on front-end of discharge cross-over tube (Fig. 1-116). The O-ring and bushing are Service parts only for internal mechanisms that have been disassembled in the field (Fig. 1-112).

3. Install new dowel pins in front cylinder half, if previously removed.

4. Install front suction reed plate on front cylinder half. Align with dowel pins, suction ports, oil return slot, and discharge cross-over tube (Fig. 1-117).

5. Install front discharge valve plate assembly, aligning holes with dowel pins and proper openings in front suction reed plate (Fig. 1-118).

Front discharge plate has a large diameter hole in the center (Fig. 1-119).

6. Coat sealing surfaces on webs of compressor front head casting with 525 viscosity refrigerant oil.

7. Determine exact position of front head casting in relation to dowel pins on internal mechanism. Mark position of dowel pins on sides of front head assembly and on sides of internal mechanism with a grease pencil. Carefully lower front head casting into position (Fig. 1-120), making certain that sealing area around center bore of head assembly does not contact shaft as head assembly is lowered. Do not rotate head assembly to line up with dowel pins, as the sealing areas would contact reed retainers.

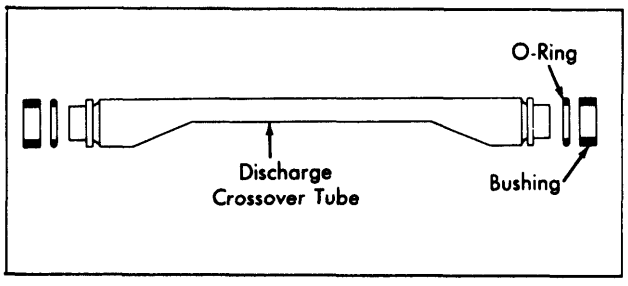


Fig. 1-112 Service Type Discharge Crossover Tube

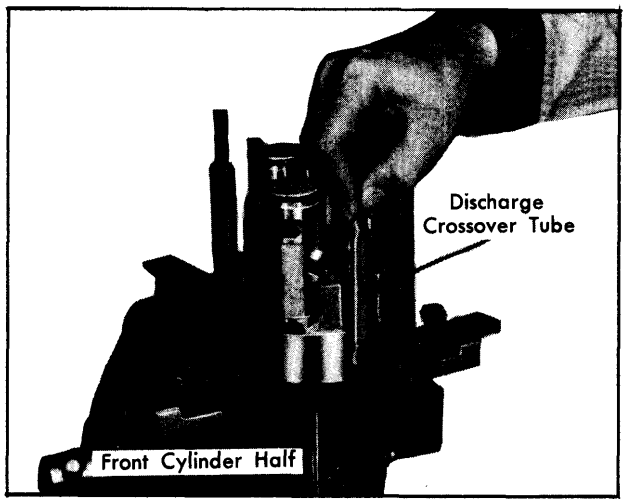


Fig. 1-113 Installing Discharge Crossover Tube

8. Generously lubricate new O-ring and angled groove at lower edge of front head casting with 525 viscosity refrigerant oil and install new O-ring into groove (Fig. 1-121).

9. Coat inside machined surfaces of compressor shell with 525 viscosity refrigerant oil and position shell on internal mechanism, resting on O-ring seal.

10. Using flat-side of a small screwdriver, gently position O-ring in around circumference of internal mechanism until compressor shell slides down over internal mechanism. As shell slides down, line up oil sump with oil intake tube hole (Fig. 1-122).

11. Holding support Block, invert assembly and place back into Holding Fixture with front end of shaft down. Remove Support Block.

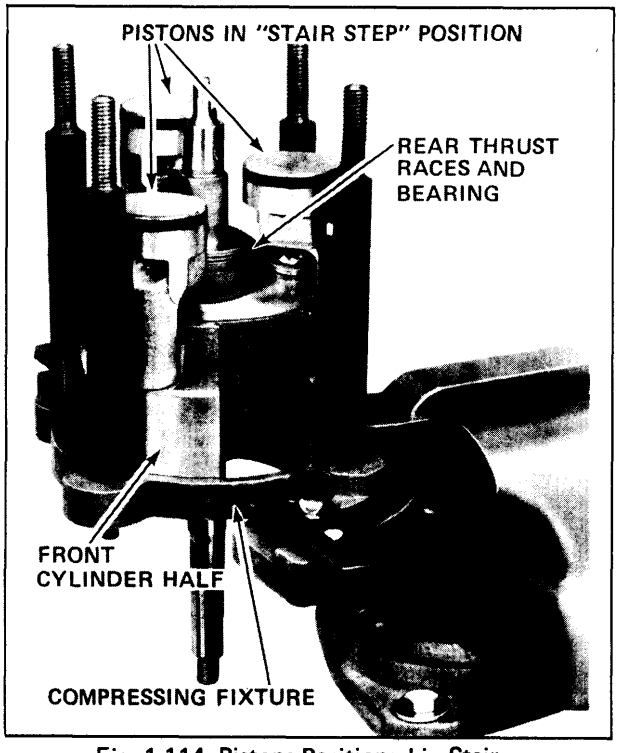


Fig. 1-114 Pistons Positioned in Stair Step Arrangement

BACK TO INDEX

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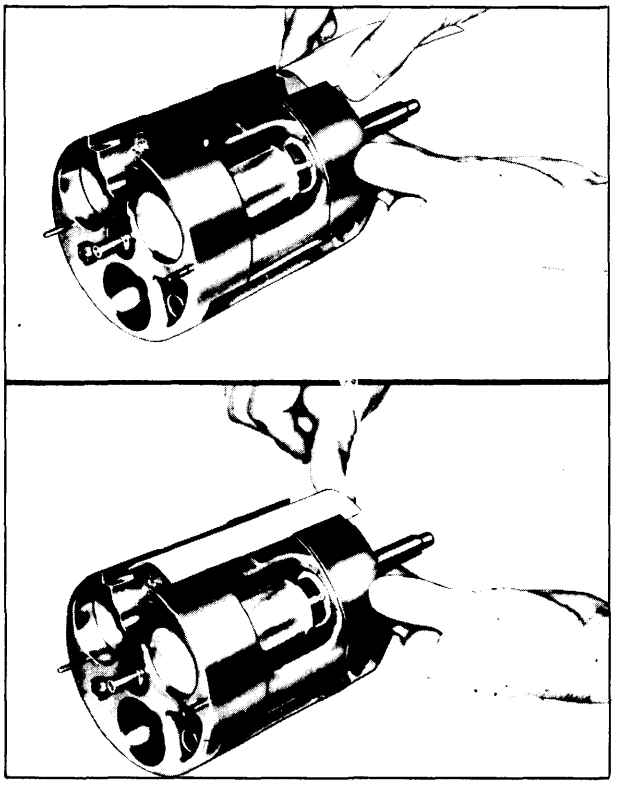


Fig. 1-115 Installing Suction Crossover Cover

12. Install new dowel pins in rear cylinder half, if previously removed.
13. Install new O-ring in oil pick-up tube cavity.
14. Lubricate oil pick-up tube with 525 viscosity refrigerant oil and install into cavity, rotating compressor mechanism to align tube with hole in shell baffle (Fig. 1-123).

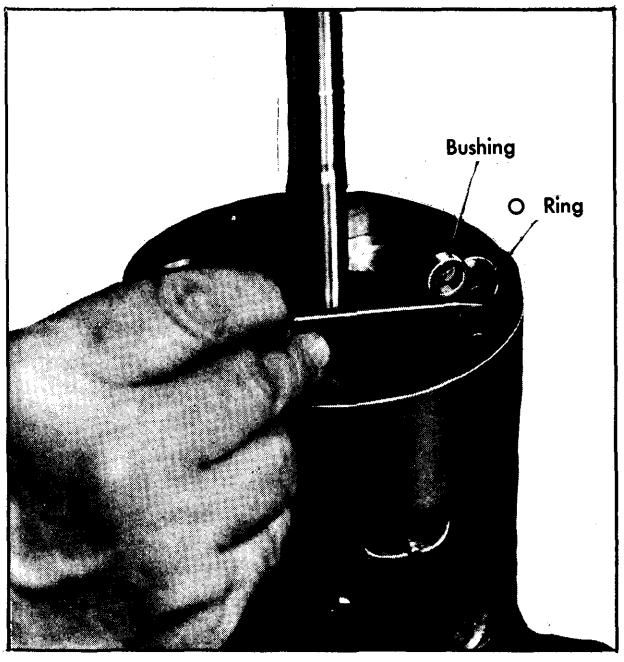


Fig. 1-116 Installing O-Ring Onto Discharge Crossover Tube

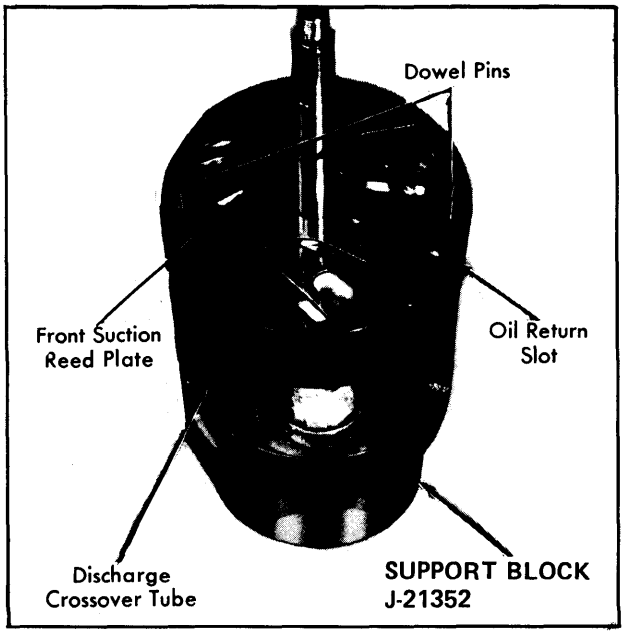


Fig. 1-117 Installing Front Suction Reed

15. Install new O-ring and bushing on rear-end of discharge cr ss-over tube (Fig. 1-112).
16. Install rear suction reed over dowel pins, with slot TOWARDS sump.
17. Install rear discharge valve plate assembly over dowel pins, with reed retainers UP.
18. Position inner oil pump gear over shaft with previously applied identification mark UP.
19. Position outer oil pump gear over inner gear with previously applied identification mark UP and, when standing facing oil sump, position outer gear so that it meshes with inner gear at the 9-o'clock position, and resulting cavity between gear teeth is then at 3-o'clock position (Fig. 1-124).

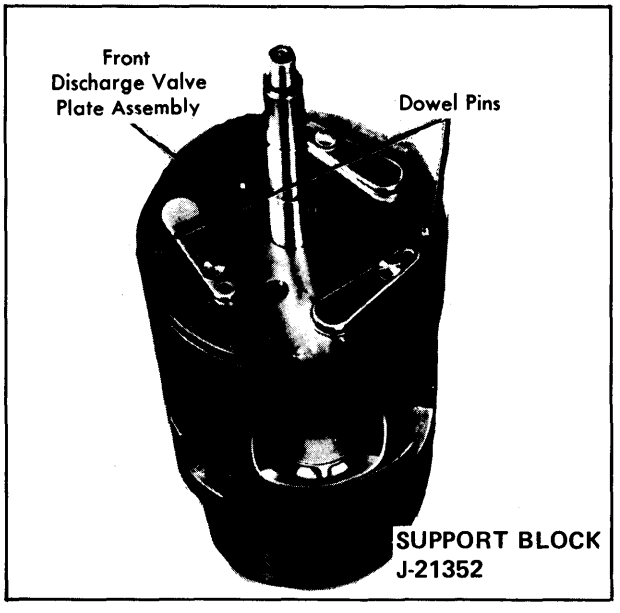


Fig. 1-118 Installing Front Discharge Valve Plate

BACK TO INDEX

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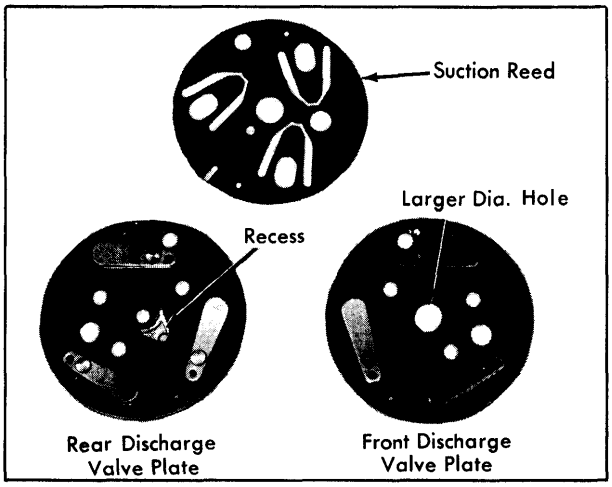


Fig. 1-119 Front and Rear Discharge Valve Plates

20. Generously oil rear discharge valve plate assembly with 525 viscosity refrigerant oil around outer edge where large diameter O-ring will be placed. Oil the valve reeds, pump gears, and area where sealing surface will contact rear discharge valve plate.

21. Using the 525 oil, lubricate new head to-shell O-ring and install on rear discharge valve plate, in contact with shell (Fig. 1-125).

22. Install suction screen in rear head casting, using care not to damage screen.

23. Coat sealing surface on webs of compressor rear head casting with 525 viscosity refrigerant oil.

24. Install rear head assembly over studs on compressor shell. The two lower threaded compressor mounting holes should be in alignment with the compressor sump.

Make certain that suction screen does not drop out of place when lowering rear head into position (Fig. 1-126).

If rear head assembly will not slide down over

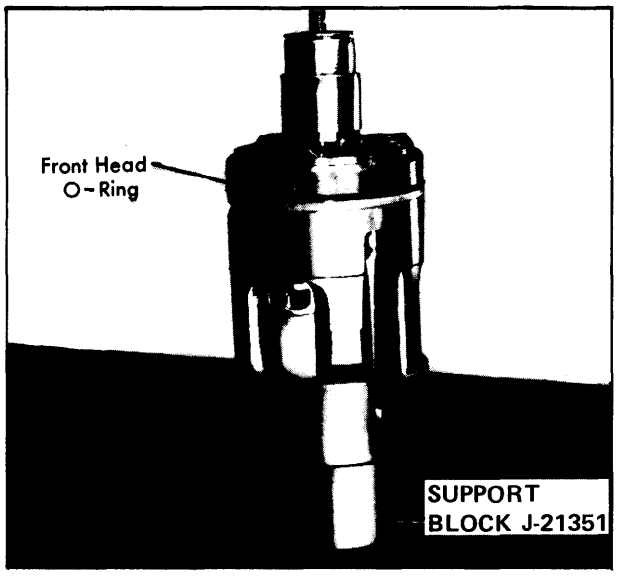


Fig. 1-121 Front Head O-Ring Installed

dowels in internal mechanism, twist front head assembly back-and-forth very slightly by-hand until rear head drops over dowel pins.

25. Install nuts on threaded shell studs and tighten evenly to 25 lb. ft. torque using a 0-50 lb. ft. torque wrench.

26. Invert compressor in Holding Fixture and Install compressor shaft seal as described in Note 45d, "Compressor Shaft Seal" Replacement procedure.

27. Install compressor clutch coil and housing assembly as described in Note 44b, "Compressor Clutch Coil and Housing Assembly" Replacement procedure.

28. Install compressor pulley and bearing assembly as described in Note 42b, "Compressor Pulley and Bearing" Replacement procedure.

29. Install compressor clutch plate and hub assembly as described in Note 41b, "Compressor Clutch Plate and Hub Assembly" Replacement procedure.

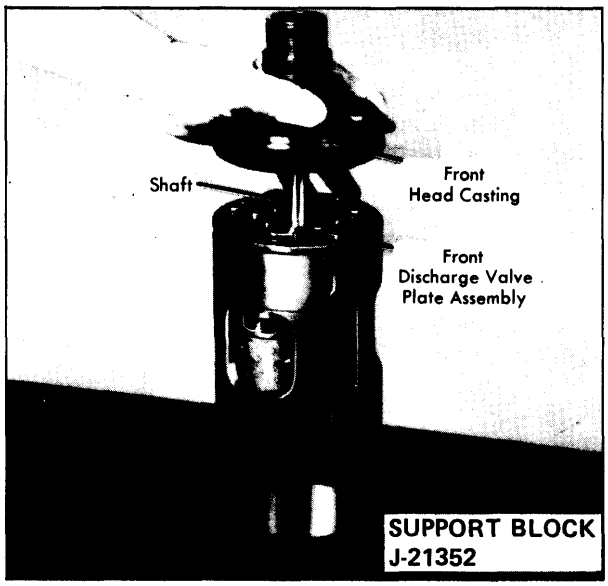


Fig. 1-120 Installing Front Head Casting

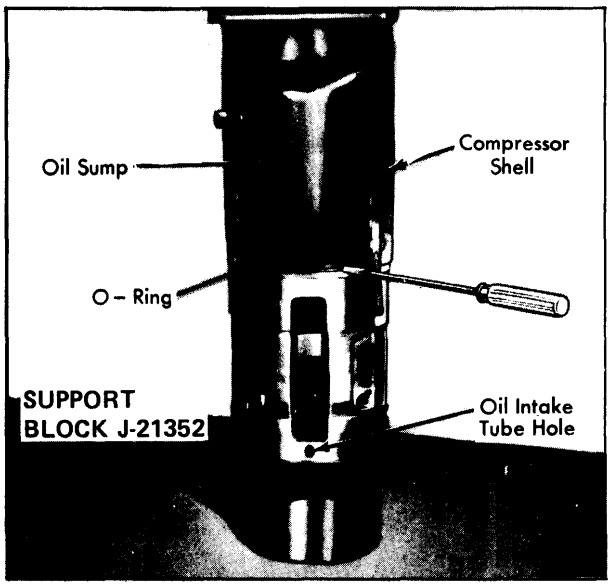


Fig. 1-122 Installing Compressor Shell

BACK TO INDEX

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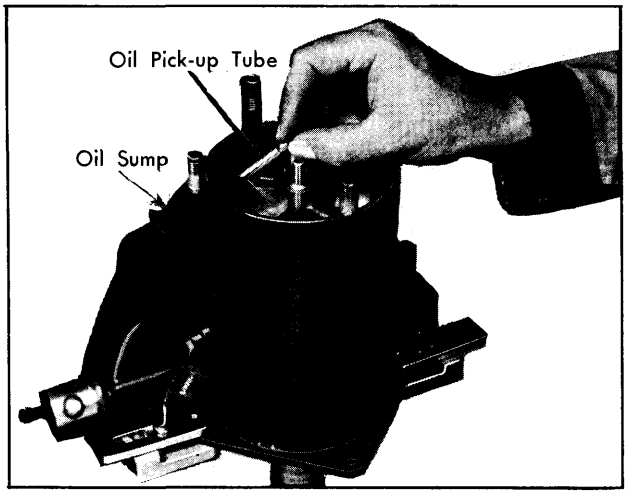


Fig. 1-123 Installing Oil Pick-Up Tube

30. Add required amount of 525 viscosity refrigerant oil (Fig. 1-61).

31. Check for external and internal leaks as described in the following "Compressor Leak Testing" procedure.

Compressor Leak Testing-External and Internal

52. Bench-Check Procedure

1. Install Test Plate J-9625 on rear head of compressor.

2. Attach center hose of gage manifold set on Charging Station to a refrigerant drum standing in an upright position and open valve on drum.

3. Connect Charging Station HIGH and LOW pressure lines to corresponding fittings on Test Plate J-9625, using J-25498 and J-5420 Gage Adapters.

Suction port of compressor has large internal opening. Discharge port has small internal opening into compressor.

4. Open LOW pressure control, HIGH pressure control and REFRIGERANT control on Charging Station to allow refrigernat vapor to flow into compressor.

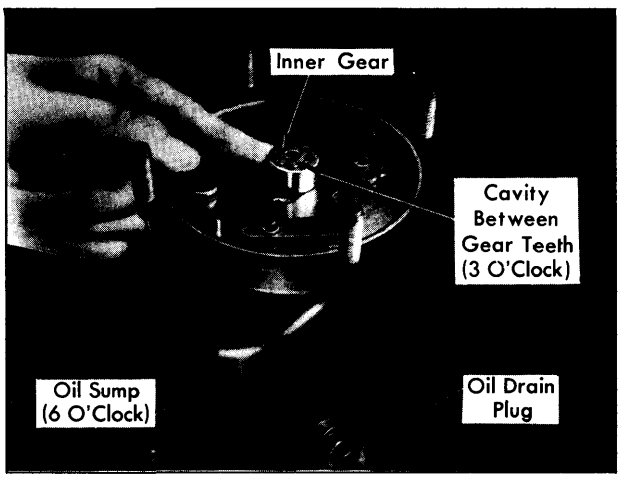


Fig. 1-124 Positioning Oil Pump Gears

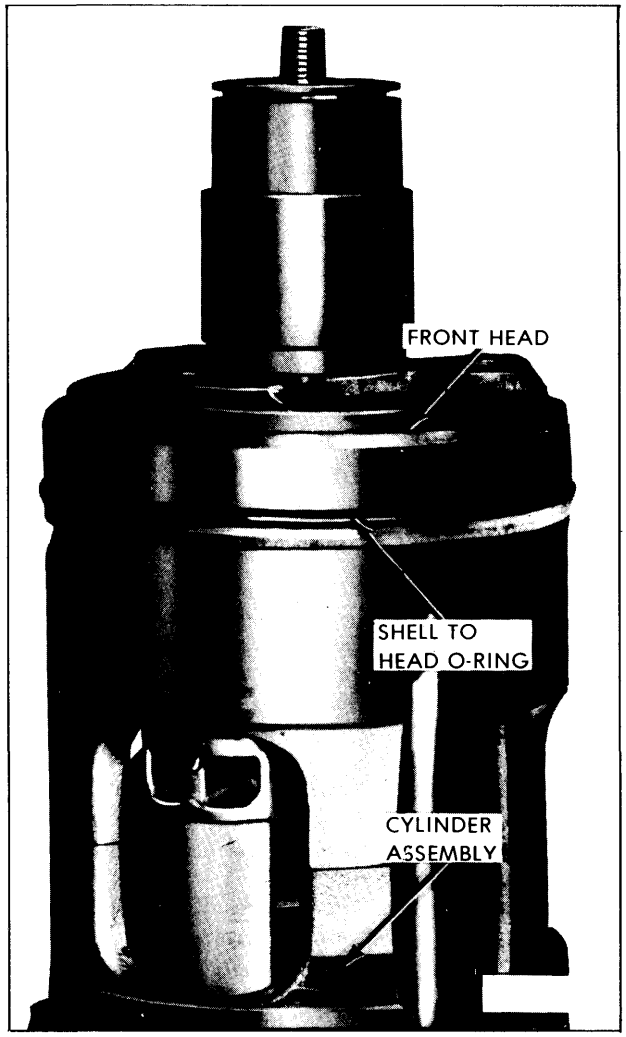


Fig. 1-125 Shell to Front Head O-Ring Installation

5. Using electronic-type Leak Detector, check for leaks at pressure relief valve, superheat switch, compressor shell to cylinder, compressor front head seal, rear head seal, oil charge port and compressor shaft seal. After checking, shut off LOW pressure control and HIGH pressure control on Charging Station.

6. If an external leak is present, perform the necessary corrective measures and recheck for leaks to make certain the leak has been corrected.

7. Loosen the manifold gage hose connections to the Gage Adapters J-5420 and J-25498 connected to the LOW and HIGH sides and allow the vapor pressure to release from the compressor.

8. Disconnect both Gage Adapters (J-5420 and J-25498) from the Test Plate J-9625.

9. Rotate the complete compressor assembly (not the crankshaft or drive plate hub) slowly several turns to distribute oil to all cylinder and piston areas.

10. Install a shaft nut on the compressor crankshaft if the drive plate and clutch assembly are not installed.

11. Using a box-end wrench or socket and handle, rotate the compressor crankshaft or clutch drive plate on the crankshaft several turns to ensure piston assembly to cylinder wall lubrication.

BACK TO INDEX

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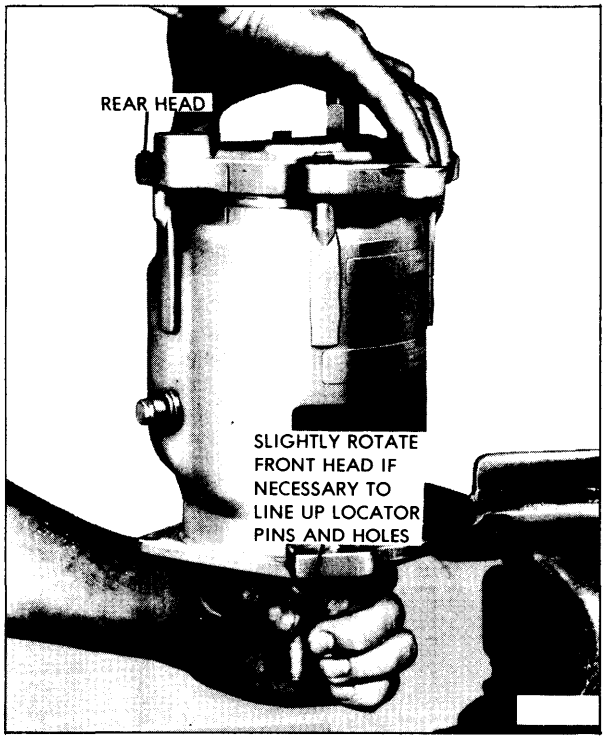


Fig. 1-126 Installing Rear Head

12. Connect the Charging Station HIGH pressure line or a HIGH pressure gage and Gage Adapter J-25498 to the Test Plate J-9625 HIGH side connector.

13. Attach a Adapter J-5420 to the suction or LOW pressure port of the Test Plate J-9625 to open the schrader-type valve.

(NOTE: Oil will drain out of the compressor suction port adapter if the compressor is positioned with the suction port down.)

14. Attach the compressor to the Holding Fixture J-9396 and clamp the fixture in a vise so that the compressor can be manually turned with a wrench.

15. Using a wrench, rotate the compressor crankshaft or drive plate hub 10 complete revolutions at a minimum speed of one revolution per second.

(NOTE: Turning the compressor at less than one revolution per second can result in a lower pump-up pressure and disqualify a good pumping compressor.)

16. Observe the reading on the HIGH pressure gage at the completion of the tenth revolution of the compressor. The pressure reading for a good pumping compressor should be a minimum of 60 p.s.i.

A pressure reading of less than 50 p.s.i. would indicate one or more suction and/or discharge valves leaking, an internal leak, or an inoperative valve and the compressor should be disassembled and checked for cause of leak. Repair as needed, reassemble and repeat the pump-up test. Externally leak test with the electronic-type Leak Detector.

17. When the pressure pump-up test is completed, release the air pressure from the HIGH side and remove the Gage Adapters J-5420 and J-25498 and Test Plate J-9625.

Remove oil charge screw and drain the oil sump.

19. Allow the compressor to drain for 10 minutes, then charge with the proper amount of oil. The oil may be poured into the suction port.

(NOTE: If further assembly or processing is required, a shipping plate or Test Plate J-9625 should be installed to keep out air, dirt and moisture until the compressor is installed.)

PROGRAMMER OVERHAUL

53. Programmer Disassembly

a. Checking Relay Removal

1. Remove programmer as described in Note 28a.
2. Remove programmer cover.
3. Remove four hoses from relay and remove relay.

b. Checking Relay Installation

1. Position checking relay in programmer with ports #1 and #2 towards vacuum motor.
2. Make the following vacuum hose connections:

a. White hose from transducer wraps around vacuum motor and connects to port #2, Fig. 1-127.

(NOTE: If this vacuum hose is replaced, the replacement hose must be at least 15" long).

b. Yellow hose from vacuum motor connects to remaining port (#1) on vacuum motor side of relay, Fig. 1-127.

c. Purple hose from "Purp" port of vacuum valve connects to center port on amplifier side of relay, Fig. 1-127.

d. Remaining black hose from center port of vacuum valve connects to outside port on amplifier side of relay, Fig. 1-127.

3. Install programmer cover.
4. Install programmer as described in Note 28b.

c. Vacuum Motor Removal

1. Remove programmer as described in Note 28a.
2. Remove programmer cover.
3. , Remove two screw/studs securing vacuum valve and swing valve out of way with hoses still attached.
4. Remove vacuum valve actuating link.
5. Remove spring from over blower contact assembly.
6. Remove spring and clip from end of vacuum motor operating link.
7. Remove three output shaft retaining screws and retainers. Disconnect output shaft from vacuum motor mechanism.

BACK TO INDEX

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8. Disengage bushing from vacuum motor to output shaft pin and from vacuum motor to blower contact mechanism.
9. Remove two screws securing vacuum motor to housing.
10. Remove yellow vacuum hose between checking relay and vacuum motor.
11. Remove vacuum motor.
12. Blower contact may be removed. However, be sure to handle assembly carefully as detent balls may fall out.

(NOTE: If blower contact is not being replaced, mark a tooth on the feedback pot and a corresponding notch on the blower switch gear).

d. Vacuum Motor Installation

(NOTE: During assembly of vacuum motor apply lubriplate or equivalent on all sliding surfaces).

1. If blower contact assembly was removed, position assembly to circuit board. Check for presence of ball in casing pivot hole. Use care to be sure that the two balls do not fall out of blower contact assembly.
2. Align marks on feedback pot and blower contact gear if parts are being reused.
3. With white vacuum hose in position, install vacuum motor to housing. Engage output shaft to blower contact assembly and secure vacuum motor with two screws.
4. Engage output shaft pin in slot of vacuum motor

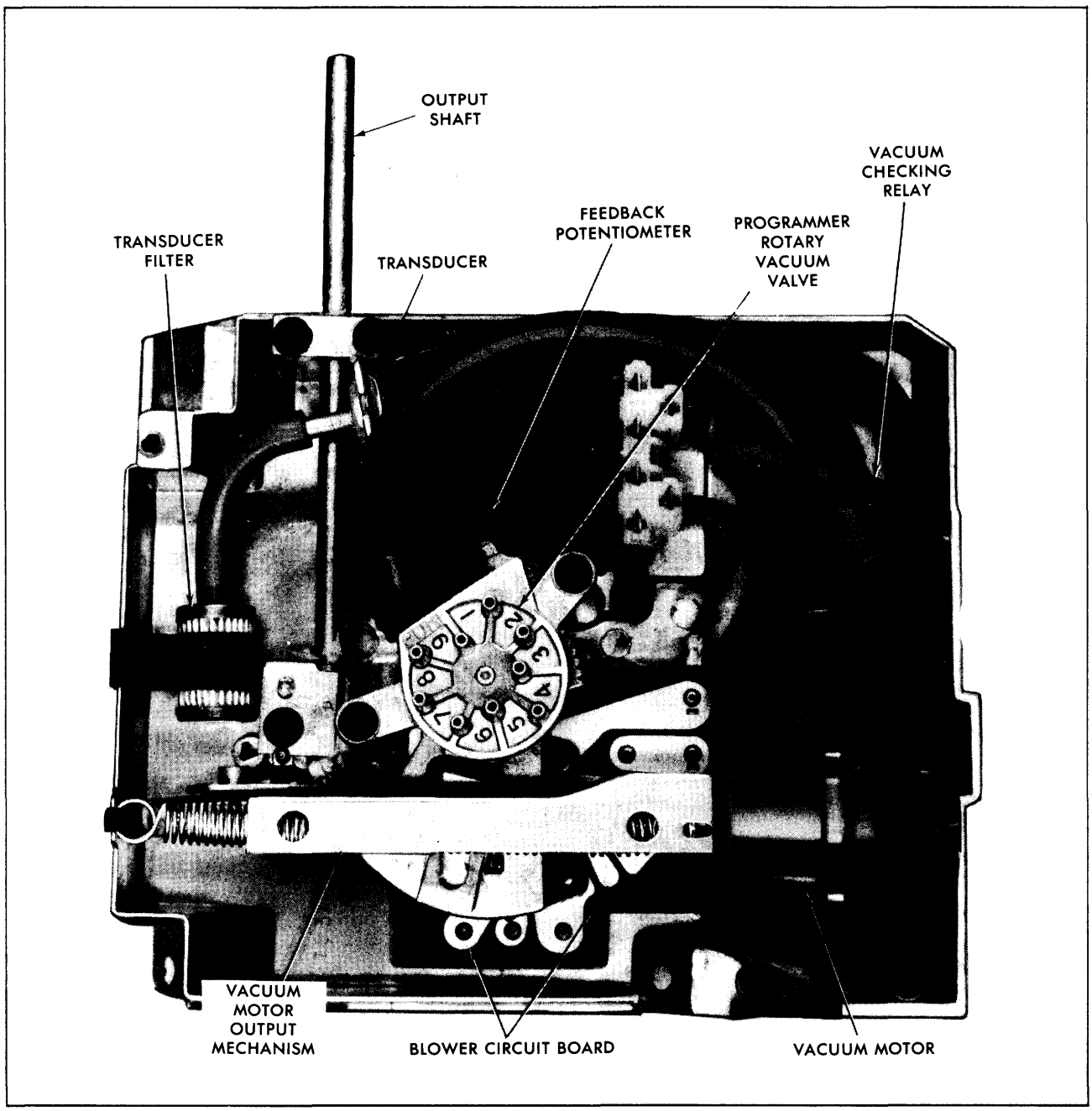


Fig. 1-127 MKII ATC Programmer Components

BACK TO INDEX

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mechanism and vacuum motor mechanism pin in slot of output shaft, being certain vacuum motor mechanism is above retaining post.

5. Install two output shaft retainers and secure with three screws being certain that lower retainer falls into undercut of output shaft.

6. Position spring over circuit board and position drive arm over pins on vacuum motor mechanism and circuit board.

7. Position vacuum valve to housing and secure with two screw/studs.

8. Connect yellow vacuum hose from checking relay to vacuum motor.

9. Hook spring over hook in vacuum motor mechanism and stretch spring so that clip may be installed on opposite end.

e. Blower Circuit Board Removal

1. Remove programmer as described in Note 28a.
2. Remove programmer cover.
3. Remove vacuum motor as described in Part c. above.
4. Remove three screws securing circuit board to housing.
5. Remove two screws securing electrical connector to housing on amplifier.
6. Remove circuit board and electrical connector as an assembly.

f. Blower Circuit Board Installation

1. Position circuit board to programmer and connector over pins on amplifier. Secure circuit board with three screws (short screw closest to amplifier) and connector with two screws.
2. Install vacuum motor as described in Part d. above.
3. Install programmer cover.
4. Install programmer as described in Note 28b.

g. Vacuum Valve Removal

1. Remove programmer as described in Note 28a.
2. Remove programmer cover.
3. Remove three vacuum hoses from vacuum valve.
4. Remove two screw/studs securing vacuum valve to housing and remove valve.

h. Vacuum Valve Installation

1. With vacuum valve spring in place, position vacuum valve to housing with pins on bottom engaged in drive arm and drive arm engaged in pins on vacuum motor mechanism and blower contact.
2. Secure vacuum valve with two screw/studs.
3. Make the following vacuum hose connections:

a. Purple hose from checking relay connects to port marked "Purp", Fig. 1-127.

b. Black hose from checking relay connects to center port of vacuum valve, Fig. 1-127.

c Small black hose from transducer connects to remaining port of vacuum valve, Fig. 1-127.

(NOTE: Do not replace this hose with hose from 1971-1974 programmer as system will lock in full heat due to absence of porous plug.)

4. Install programmer cover.
5. Install programmer as described in Note 28b.

i. Amplifier-Transducer Removal

1. Remove programmer as described in Note 28a.
2. Remove programmer cover.
3. Remove vacuum hoses from transducer.
4. , Remove two screws securing electrical connector to housing and remove connector from position over amplifier contacts.
5. Remove two screws securing potentiometer and amplifier to housing and remove amplifier-transducer assembly.

j. Amplifier-Transducer Installation

1. Position amplifier-transducer to housing and secure with two screws at potentiometer.
2. Position electrical connector over amplifier terminals and secure connector with two screws.
3. Connect vacuum hoses to transducer.
4. Install programmer as described in Note 28b.
5. Calibrate feedback pot as described in Note 15c.
6. Install programmer cover.

BACK TO INDEX

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THEORY OF OPERATION
FLEETWOOD SEVENTY-FIVE REAR AIR CONDITIONER

Two separate air conditioning systems are used in the Fleetwood Seventy-Five Cadillac. In each system automatic temperature control is provided. The front compartment system utilizes the same components and operates in the same manner as the air conditioner on all other model cars, with the following exceptions:

The front system refrigerant and heater water hoses have "tee" connections incorporated to provide feed to the rear system.

The rear compartment system utilizes a series-flow, reheat-type evaporator, heater and blower assembly, located on the axle kickup shelf in the trunk compartment. This assembly draws car interior air from the rear compartment through the package shelf, cools and reheats it as required, and discharges it into the passenger compartment through overhead roof ducts or through duct-work and grilles in the rear doors. When the system operates in heater mode, a portion of the heated air is directed at the rear window through grilles in the package shelf for defrosting purposes.

A complete string of sensors, an amplifier, a transducer, a power servo and other temperature control components are utilized in the rear system. A description of these follows.

Automatic Climate Control Components (Fig. 1-128 and Fig. 1-129)

a. Sensors

The in-car sensor, mounted in a grille located on the rear package shelf, senses the temperature of the rear passenger compartment as well as the sun load on the rear of car.

The duct sensor senses the discharge air temperature. It is located in the mode door assembly on the right side of the car where it is exposed to all discharge air entering this area.

The ambient sensor is located with the ambient sensor for the front system on the top of the evaporator case. It senses the temperature of the ambient air entering the system.

b. Temperature Dial

The temperature dial is located in the right rear quarter panel trim. The dial is graduated in 5°F divisions to allow the passenger to select any temperature in the 65°F to 85°F range.

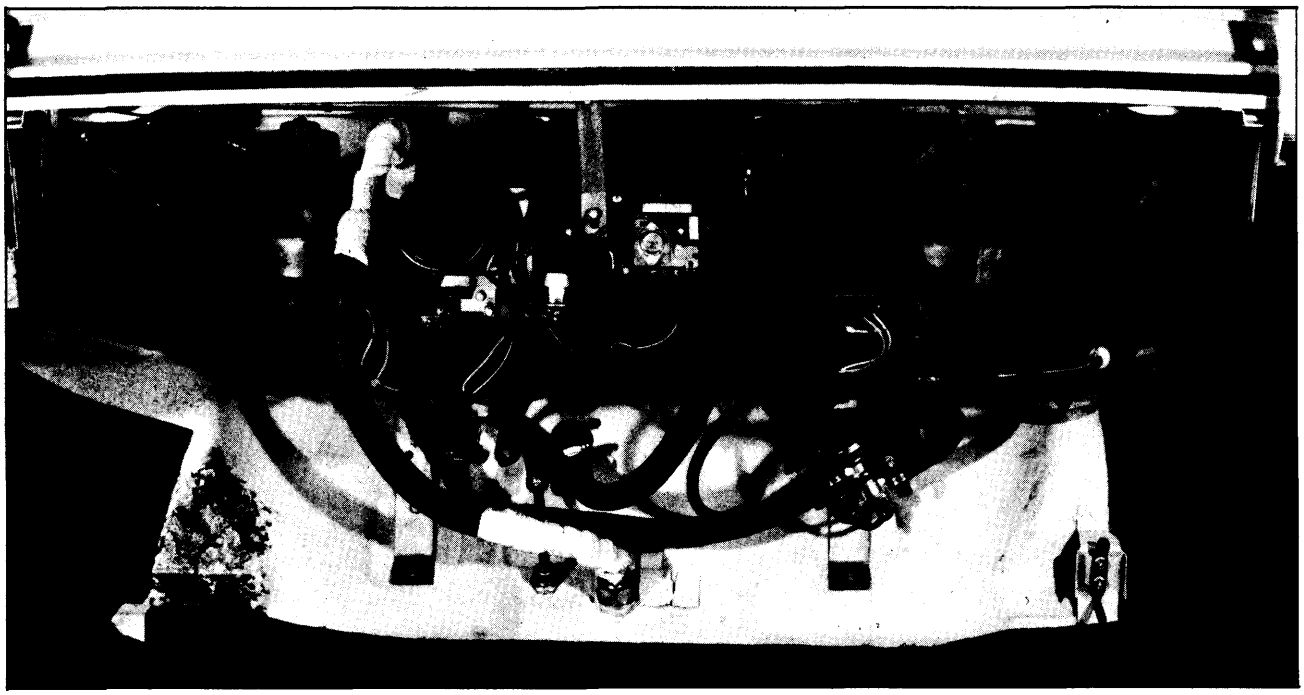


Fig. 1-128 Rear Climate Control Unit — In Car

BACK TO INDEX

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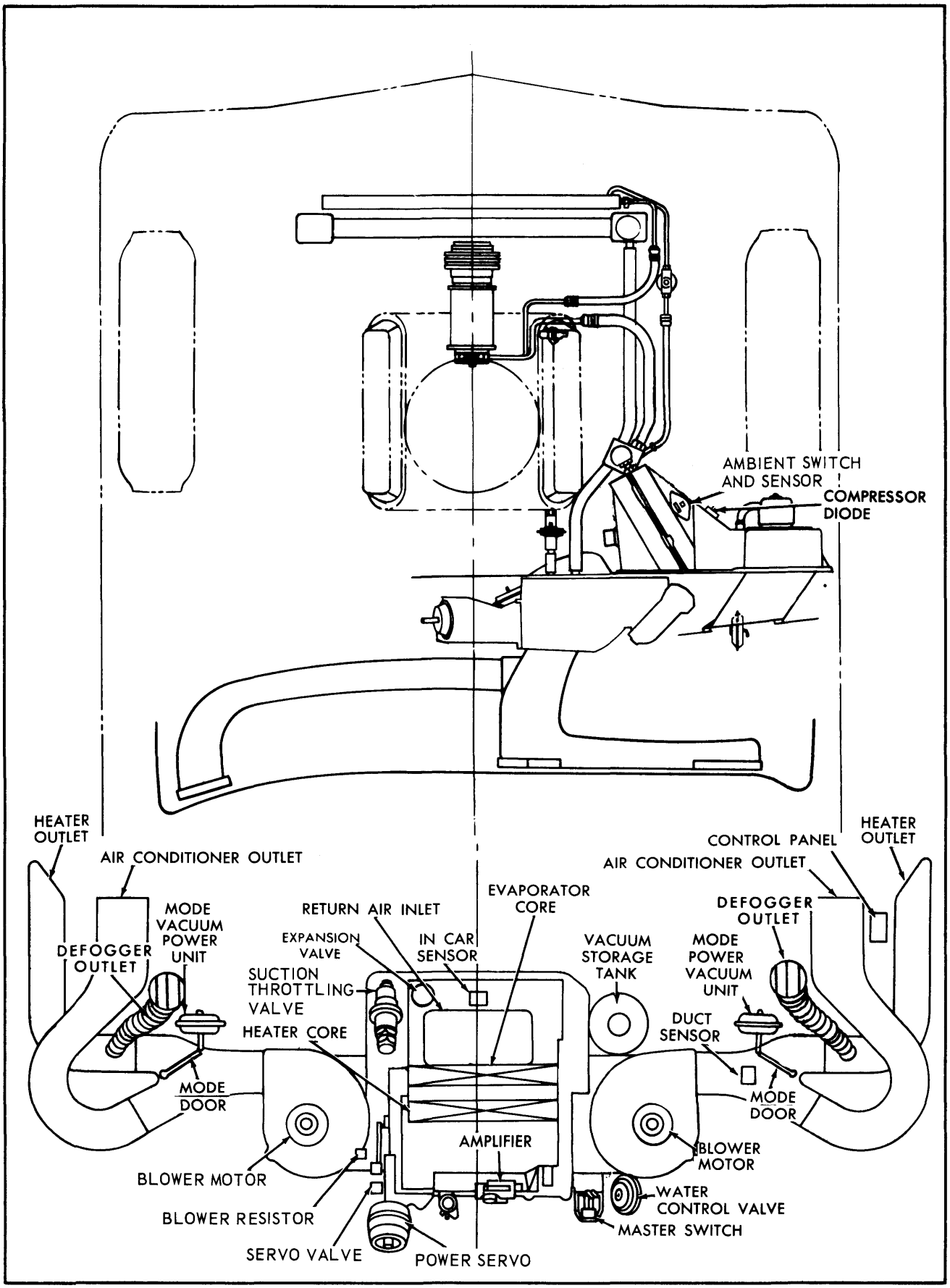


Fig. 1-129 Location of Rear Climate Control Units

BACK TO INDEX

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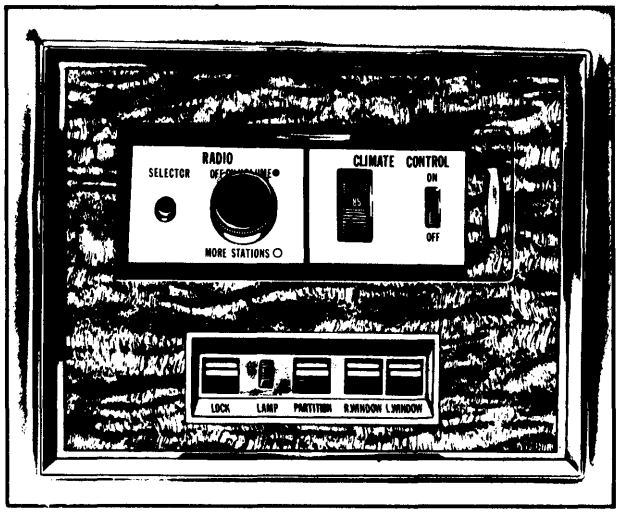


Fig. 1-130 Control Panel – Rear Unit

c. Vacuum On-Off Switch

The Vacuum On-Off switch is located with the temperature dial in the right rear quarter panel trim. This switch allows the passenger to turn the rear system off.

d. Amplifier

The amplifier is mounted on the rear face of the rear unit case assembly in the trunk.

e. Transducer

The transducer for the rear assembly is mounted on the rear face of the case assembly just to the left of the amplifier.

f. Power Servo

The power servo is mounted on the left vertical surface of the case assembly.

POA Suction Throttling Valve

The Pilot Operated Absolute suction throttling valve is located on the left front side of the evaporator assembly, in the low pressure line to the compressor. The valve body contains two ports; the evaporator gage port on the inlet side of the valve, and a port on the outlet side for the external equalizer line.

This valve is calibrated to control the rear evaporator pressure to 27 psi.

Expansion Valve

An expansion valve is used in the rear system to perform the same function as the valve used in the front system. The rear expansion valve is contained within the evaporator case on the lower left front side.

Evaporator

The evaporator used on the rear system is smaller and of different construction than that used in front systems. The rear evaporator is located in the case assembly in the luggage compartment under the package shelf.

Blower Assemblies

Two blower assemblies are used on the rear system. Air from the heater air conditioner assembly is drawn into blower assemblies on either side of the case and then expelled into the car.

Control Panel

The control panel, (Fig. 1-130, located in the right rear quarter panel trim, consists of a temperature dial and an ON-OFF switch. The temperature dial is graduated in 5 degree divisions from 65°F to 85°F. This dial is used to select the desired temperature. The ON-OFF switch controls vacuum feed to the rear system and is used to turn the system On or Off.

Vacuum Circuit

The Automatic Climate Control system incorporates two basic vacuum circuits. The first circuit controls the position of the power servo unit, and the second circuit controls the operation of the various vacuum operated components of the system.

The vacuum feed to the rear system is through a 1/4" rubber hose connected near the back-up lamp switch at the left side of the instrument panel. The hose travels up along the center vent duct to the right-hand side of the car and then along the floor down the right-hand side of the car to a tee located at the rear of the rear A/C unit. One leg of the tee feeds vacuum to the vacuum storage tank which, in turn, connects the transducer and the power servo vacuum diaphragm. The other leg of the tee feeds vacuum to a check valve, the control "On-Off" switch, and the power servo vacuum valve.

To trace the path of the vacuum, refer to the servo valve connections (Fig. 1-131) and to rear automatic climate control vacuum schematic (Fig. 1-132.)

Operation

a. Off

(NOTE: Assume the control switch is in the Off position, and the engine is running.)

Whenever the engine is operating, the sensor string is transmitting a signal to the amplifier. The signal is converted to a proportionate DC voltage by the amplifier, and is fed to the transducer. The transducer converts the electrical signal to a proportionate regulated vacuum output that is supplied to the vacuum power unit of the power servo, thus placing the power servo unit in the proper operating position, if the system were to be started.

b. Maximum Cooling

(NOTE: Assume the ambient air temperature is 90°F, the in-car temperature is 90°F, the temperature dial rheostat is set at 75°F, and the engine is running.)

Due to the high temperatures acting on the sensors, the resistance values of the sensors will be low, causing a

BACK TO INDEX

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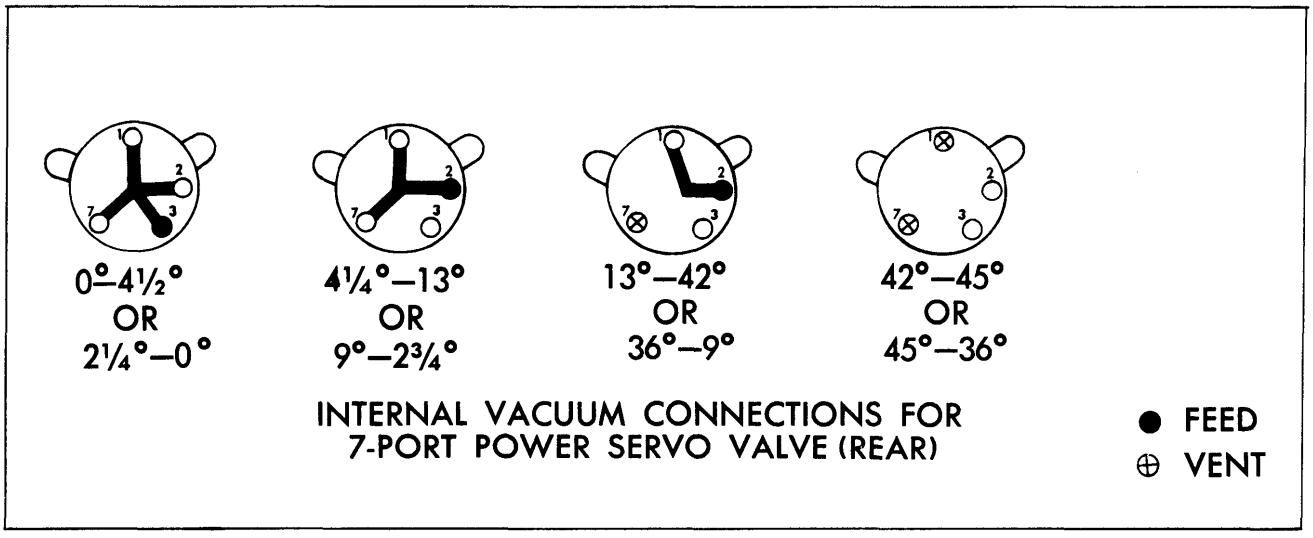


Fig. 1-131 Rotary Valve Internal Connections – Rear Unit

strong signal to the amplifier. The output of the amplifier is high, and is being fed to the transducer, where it is converted to a weak vacuum output, causing the power servo to be in the maximum air conditioning position.

When the switch is placed in the "ON" position, vacuum is fed to the master switch, completing the electrical circuit to the blower motor and compressor, and to the servo vacuum valve. In the maximum air conditioning position, the servo valve performs the following vacuum functions:

The mode doors are moved to the air conditioning position, allowing the discharge air to be discharged through the air conditioner outlets. The water control valve is closed, preventing the flow of engine coolant to the heater core.

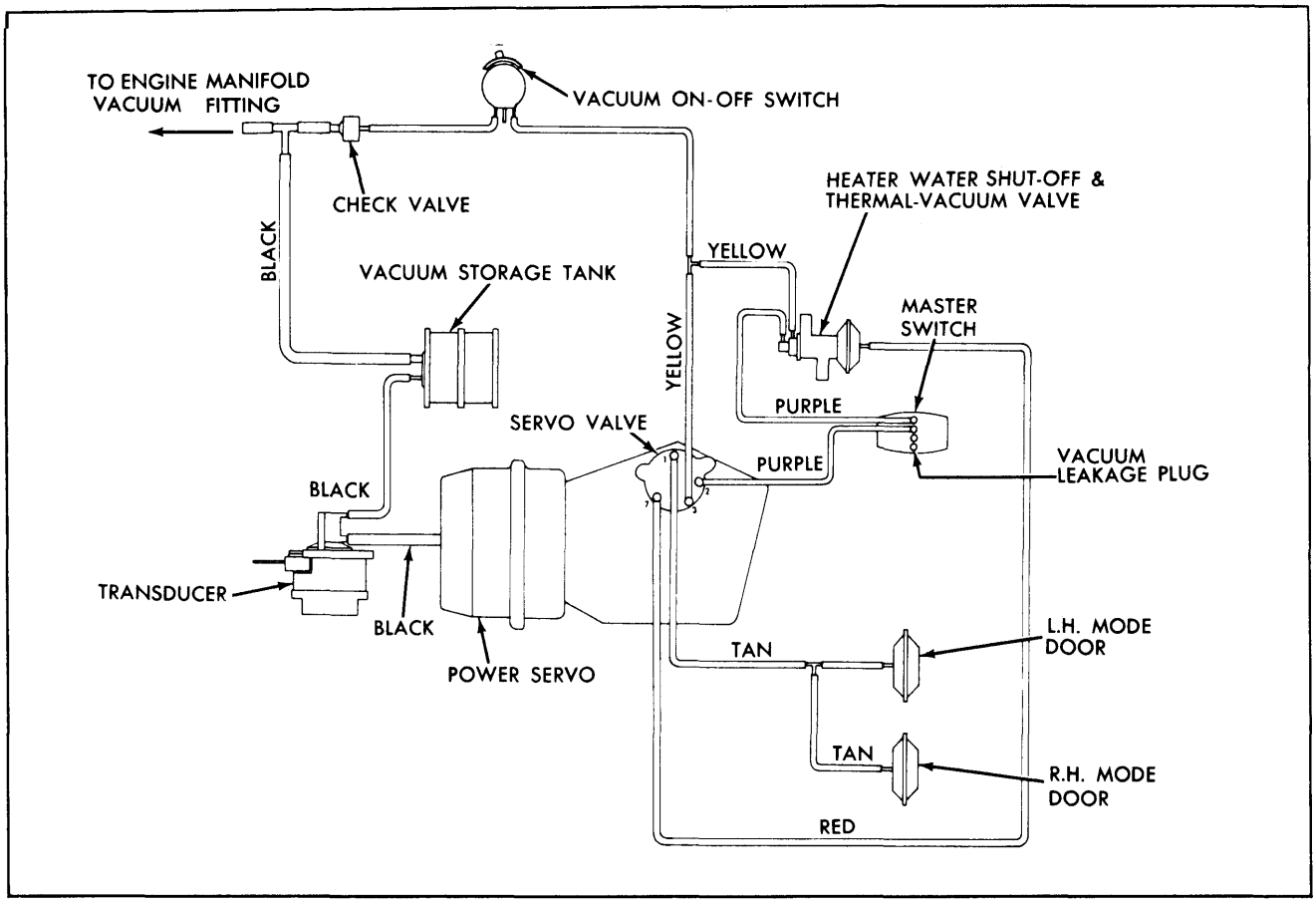


Fig. 1-132 Vacuum Schematic – Rear Climate Control Unit

BACK TO INDEX

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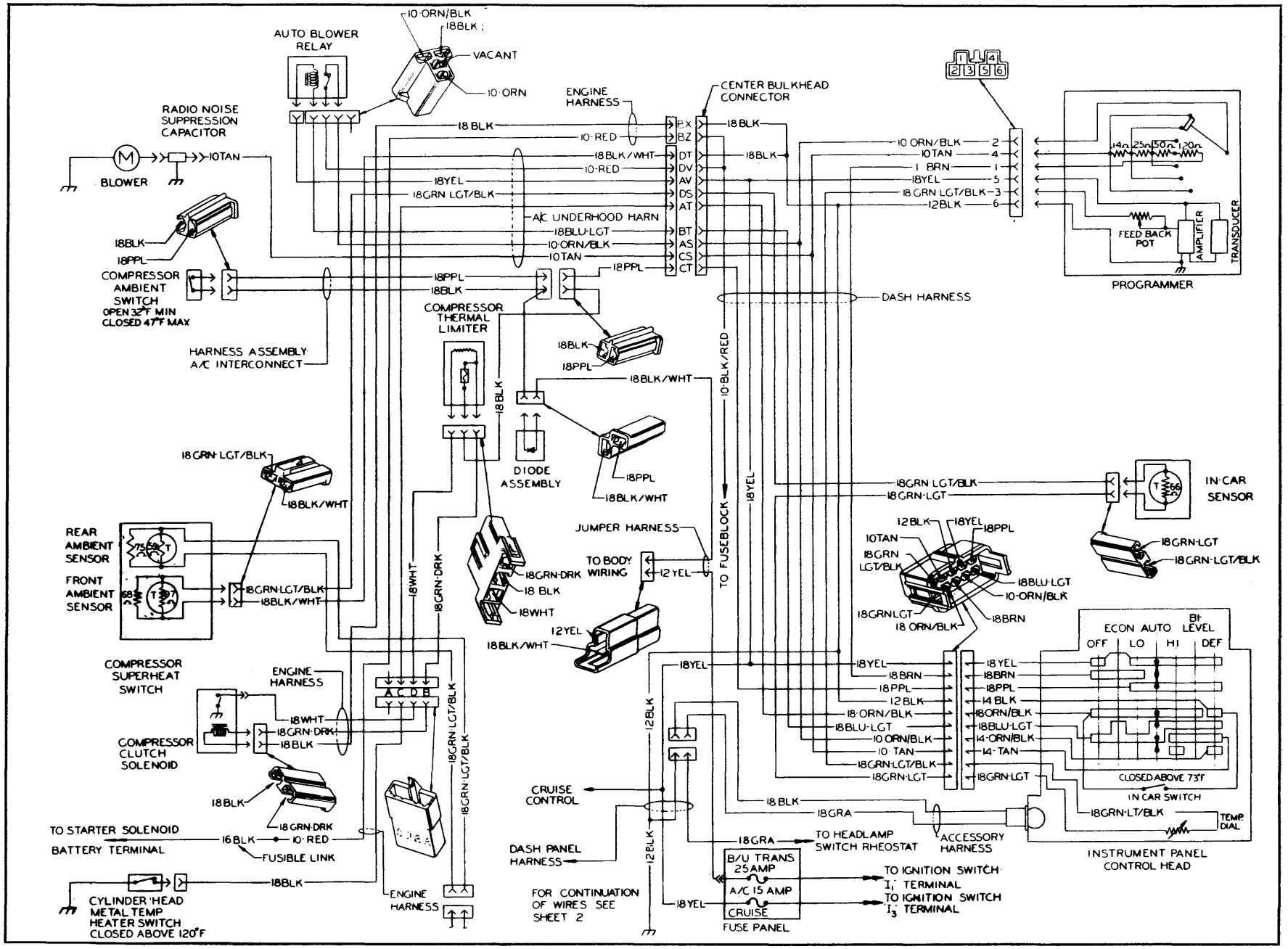


Fig. 1-134 Front Climate Control Wiring Circuit Diagram

BACK TO INDEX

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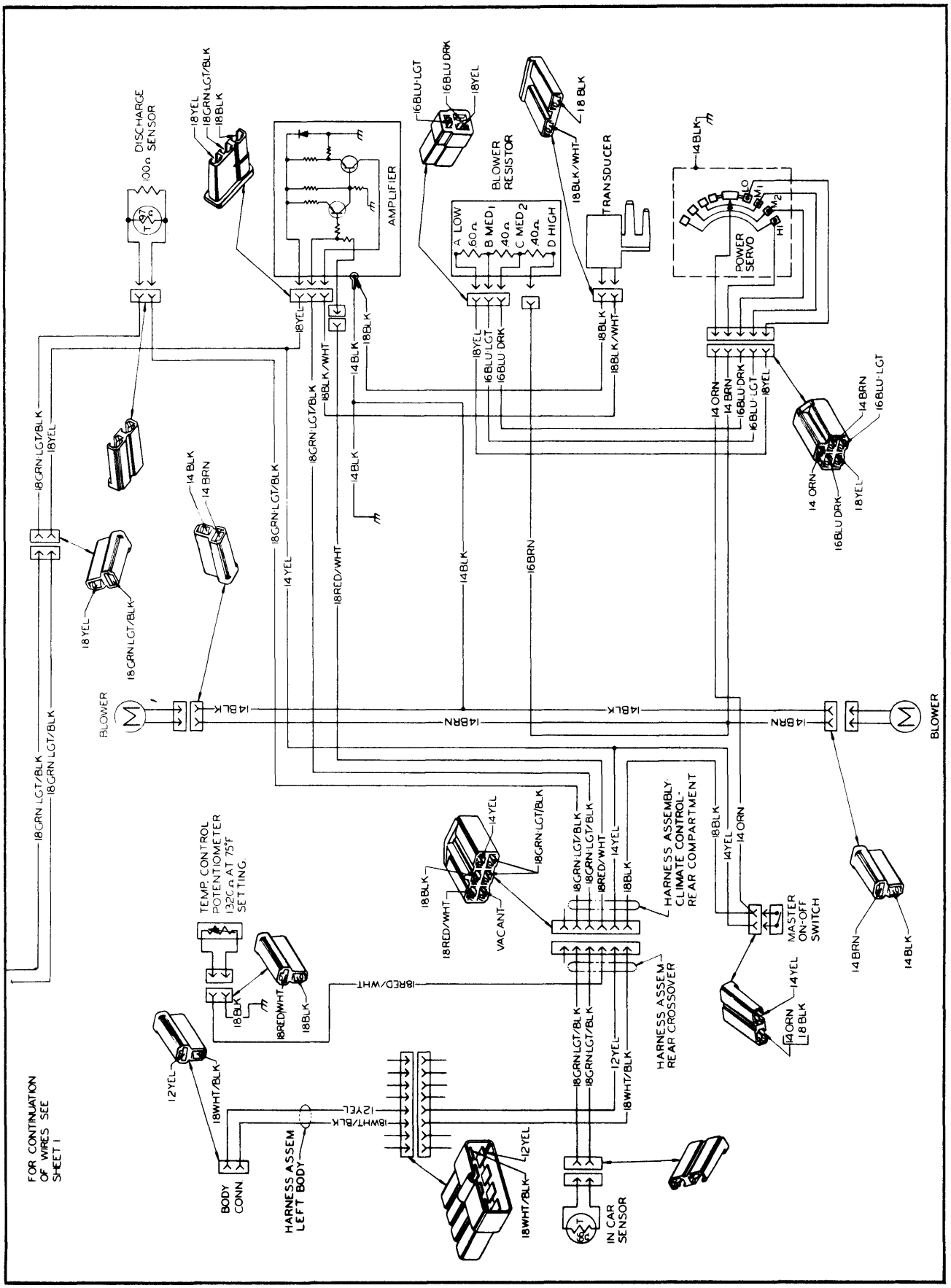


Fig. 1-134 Front Climate Control Wiring Circuit Diagram

BACK TO INDEX

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In addition, the power servo has placed the temperature door in the maximum cooling position, preventing any air flow through the heater core. The blower is operating at HIGH speed.

As the system operates the in-car and duct sensors, sensing the lowering temperatures, increase in resistance, causing more vacuum to be fed to the power servo unit. The power servo then performs the necessary events, in the proper sequence, Fig. 1-133, until such time as the system reaches a balanced position to hold the interior temperature to the dial setting.

As the vacuum supplied to the power servo vacuum power unit increases, the position of the operating arm and the servo vacuum valve changes. The blower decreases to M2 speed. Vacuum to the hot water valve is cut off, causing the hot water valve to pass engine coolant.

As the system continues to modulate, the blower will decrease to M1 speed and then the position of the temperature door will change to allow the entry of heated air that will mix with the cooled air. Continued modulation by the system can decrease the blower to LOW speed. The system will modulate itself to maintain the interior temperature, regardless of any change in the ambient air temperature.

If the ambient air temperature were to fall quite rapidly, the ambient sensor resistance value would increase, causing a weaker voltage signal to be sent to the transducer. The power servo unit would move towards the heater position as the vacuum output from the transducer was increased. The system would switch into the heater mode and the blower speed would increase to M1, then M2, and M3. During the increase of blower speeds, the temperature door would be traveling toward the maximum heat position and eventually would prevent all cold air from entering the system.

c. Maximum Heat

(NOTE: Assume the ambient air temperature is 0°F, (-17°C), the in-car temperature is 0°F, the temperature dial is set at 75°, and the engine is running.)

Power Servo Arm Angle		Event
Increasing Vacuum	Decreasing Vacuum	
4-1/4°	2-3/4°	A/C Over Ride Begin - End
13°	9°	Water Control Valve Close - Open
42°	36°	Change Mode A/C - Heat

Fig. 1-133 Power Servo Sequence — Rear Unit

Due to the low temperatures acting on the sensors, their resistance values will be high, causing a weak signal to the amplifier. The output of the amplifier is low, and is being fed to the transducer, where it is converted to a strong vacuum output causing the power servo to move toward the maximum heat position.

In the heat mode, the vacuum circuitry is such that the vacuum must pass through the thermal vacuum valve in order to actuate the master switch. The compressor clutch circuit is held open by the ambient switch in the front unit any time it is below 32°F (0°C).

Once the engine coolant has reached the temperature of approximately 140°F (60°C), vacuum flows through the thermal vacuum valve, causing the outside air door to open and the blower to operate at HIGH speed, admitting heated air into the car. The in-car and duct sensors sense the temperature rise and, as their resistance values lower, the system begins to modulate and the blower speeds will diminish to M2, M1 and then to LOW.

During the decrease in blower speeds, the temperature door would travel from the maximum heat position to a mid-position, blending heated and cooled air. If the outside air temperature were to rise to about 35°F (2°C), the compressor clutch circuit would close, causing compressor operation to begin. Continued temperature increases, sensed by the sensors, cause the system to move toward the air conditioning position.

Electrical Circuit (Fig. 1-134 and 1-135)

The Automatic Climate Control electrical circuit flows from the accessory terminal of the ignition switch to the 15 ampere fuse in the fuse block, and then to the amplifier, to the ambient sensor, and to the master switch.

The master switch sends current through the diode assembly, mounted behind the instrument panel, to energize the compressor clutch when the front unit ambient switch is closed. A compressor diode assembly is incorporated into the compressor circuit of the front and rear units on the Fleetwood Seventy-Five systems. The compressor diode assembly permits either unit to supply current to the compressor clutch without causing a feed back into the other system. A feed back from the front system into the rear system would cause the master switch to be overridden and the system's blower to operate even though the rear system was turned off. The compressor diode assembly is mounted on the front of the evaporator case, Fig. 1-129.

The sensor string circuit current flows from the ambient sensor to the discharge air sensor, to the in-car sensor, and then to the amplifier.

BACK TO INDEX

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SERVICE INFORMATION
FLEETWOOD SEVENTY-FIVE REAR AIR CONDITIONER

77. Adjustments

a. Temperature Door Link

1. Loosen temperature door adjusting link screw.
2. Apply vacuum to power servo vacuum power unit.
3. Tighten temperature door adjusting link until head of screw contacts link then continue to tighten just enough to take play out of link.

b. Temperature Dial

(NOTE: If system is working properly, perform temperature dial test as described in Notes 56a, step 6, 56a, step 7, or 56c.)

Although the temperature dial may be operating correctly, it may be necessary to change the temperature dial setting for customer satisfaction. If an owner indicates a particular temperature dial setting where he is most comfortable, set temperature dial to that setting and proceed as follows:

1. Insert Temperature Dial Adjuster, J-21530, between temperature dial and casting. (Refer to Fig. 1-47.)
2. Turn dial to proper setting as determined by test procedure used.

78. Performance Test

To determine the efficiency of the Fleetwood Seventy-Five Air Conditioning system, run a performance test as outlined below:

1. Place transmission in PARK and start engine.
2. Check operation of controls by rotating temperature dials from stop to stop.
3. Turn off engine.
4. Purge high and low pressure lines on Charging Station J-23500.
5. Connect Charging Station high pressure line to fitting on high pressure vapor line, and low pressure line to evaporator gage fitting on suction throttling valve.
6. Disconnect vacuum hoses from both power servo vacuum power units and plug hoses.
7. Close hood as far as possible without pinching lines.
8. Place auxiliary fan (approximately 24 inch dia. blades) 24 inches from front bumper and direct air stream to center of radiator grille.
9. Place thermometer in air stream between auxiliary fan and radiator grille. Thermometer bulb must not contact any metal.
10. Place another thermometer in right front air conditioning outlet grille. Thermometer bulb must not contact any metal.
11. Open all doors and windows.
12. Use Humidicator, J-6076, to obtain simultaneous temperature and relative humidity readings of air entering air intake grille as follows:
    a. Shake thermometer down to settle red and blue columns in bottom of tubes.
    b. Throughly moisten wick on blue thermometer with water.
    c. Place humidicator on right hand side of cowl air intake grille so that entering air passes over bulbs of thermometer.
13. Place thermometer in right rear roof outlet and open deflector doors.
14. Place another thermometer on center of package shelf over return air intake.
15. Turn on auxiliary fan.
16. With transmission in PARK, start engine and operate at 2,000 rpm.
17. After five minutes, record:
    a. Humidicator red and blue bulb readings. (Red bulb reading is temperature of air entering air intake grille.)
    b. Temperature of air being discharged through right front air conditioning outlet.
    c. Temperature of air entering grille.
    d. Head pressure.
    e. Front evaporator pressure.
    f. Temperature of air being discharged from right rear outlet.
    g. Temperature of air returning to rear evaporator assembly.
18. Turn off engine and auxiliary fan.
19. To determine relative humidity of air entering air intake grille, position inner scale of humidicator so that blue (wet bulb) temperature is opposite red (dry bulb) temperature. Relative humidity is indicated by humidity arrow. Record relative humidity.
20. Refer to Chart C, Fig. 1-136 to determine if outlet air temperatures are normal. If outlet temperatures are the same or below reading on chart, operation is normal.
21. Refer to Chart D, Fig. 1-136 to determine if head pressure is normal. If head pressure is within 30 pounds below reading on chart, operation is normal.
22. Disconnect Charging Station.
23. Install vacuum hose on power servo vacuum power units after unplugging.

79. Connecting Automatic Climate Control Tester

The Automatic Climate Control Tester, J-21512, and the Automatic Temperature Control Tester, J-22368-01,

BACK TO INDEX

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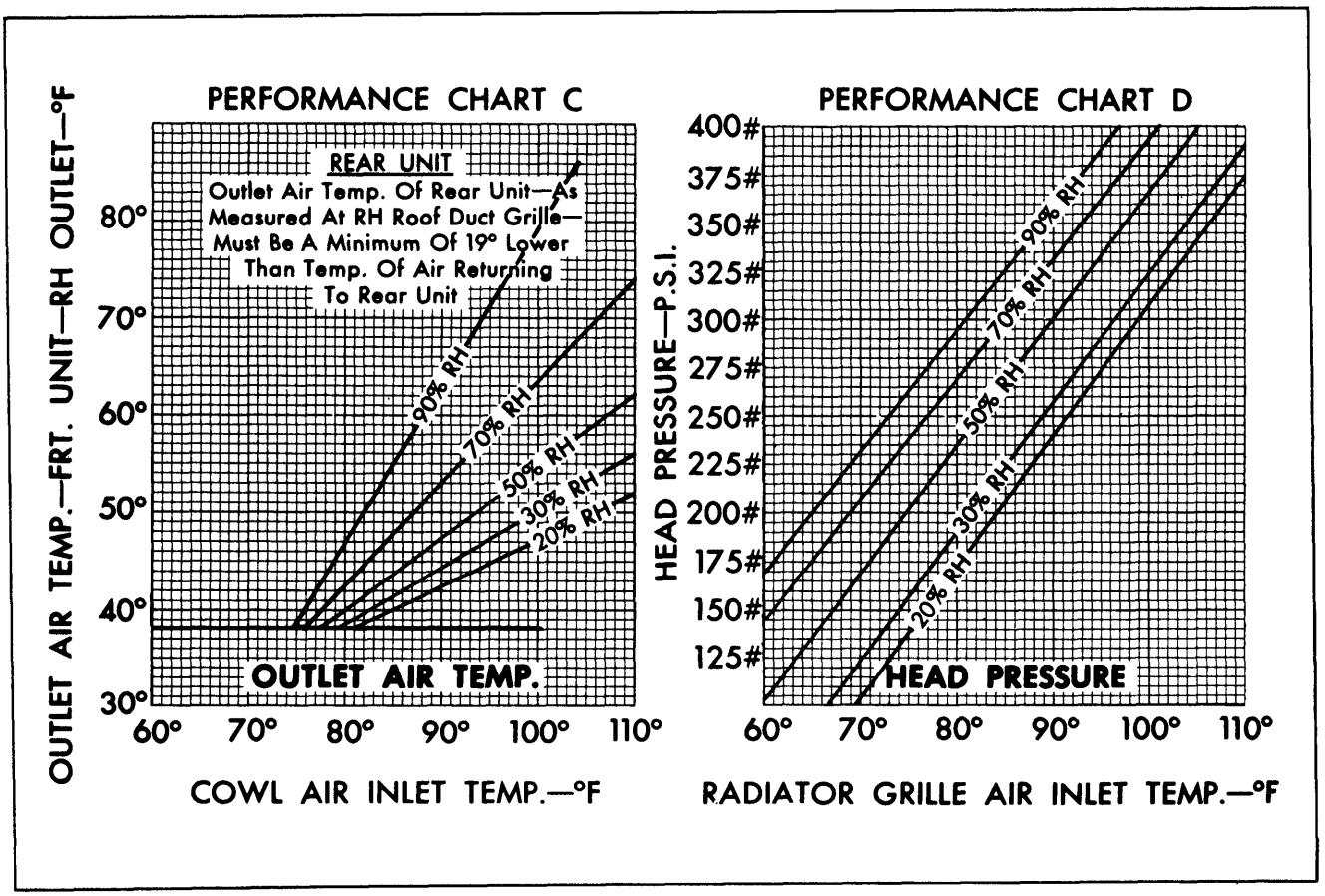


Fig. 1-136 Climate Control Performance Chart — Rear Unit

are used to isolate an electrical malfunction in the Automatic Climate Control system by serving as a substitute for components of the system. Due to differences between the testers, two procedures are given in this note. Follow the test procedure that applies to the tester to be used.

This procedure is designed to assist servicemen in locating a malfunction in the Automatic Climate Control system, when the system turns ON, but operates only in maximum heat or maximum air conditioner at high blower speed. If the system is operating incorrectly, but does have some degree of self-modulation, first check adjustment of temperature dial as described in step 6. If system still performs incorrectly, proceed as follows:

(NOTE: For positive results, the Automatic Climate Control system should be tested in an area where the ambient temperature is between 70°F and 80°F. If the ambient temperature is below 70°F, the system may not produce full air conditioning, or if above 80°F, the system may not produce full heat.)

a. Automatic Climate Control Tester, J-21512

1. Preliminary Test

a. Place transmission in PARK and start engine.

b. Disconnect vacuum hose from power servo vacuum power unit, and seal hose with thumb. System and power servo should go to full air conditioning.

c. Connect a vacuum hose from vacuum supply line to power servo vacuum power unit. System and power servo should go to full heat. Reinstall vacuum hoses.

d. If system and power servo performed properly in stops b and c, proceed to step 2.

e. If power servo performed properly, but system did not, in steps b and c, proceed to step 5.

f. If power servo and system failed to perform properly, proceed to step g.

g. Check power servo and temperature door for binding or other mechanical interference. If no mechanical interference is found, replace power servo unit.

2. Sensor String Test

a. Turn engine off if still operating, and connect Automatic Climate Control Tester, J-21512.

b. Set temperature dial to 71° setting.

c. With transmission in PARK position, start engine.

d. Place Amplifier switch on Automatic Climate Control Tester, J-21512, in SENSOR position.

e. Place Sensor switch to A/C position, System and tester meter should go to full air conditioning.

f. Place Sensor switch in HTR position. System and tester meter should go to full heater.

g. If system did not perform correctly in steps e and f, proceed to step 3.

h. If system performed correctly, disconnect Automatic Climate Control Tester and reconnect car wiring harness. Visually inspect in-car sensor, replace if

BACK TO INDEX
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apparently malfunctioning, and check operation of system.

i. Check for loose connector at duct sensor and then at ambient sensor. If loose connector is found, repair and check operation of system.

j. If an ohmmeter is available, measure resistance value of ambient sensor, and then in-car sensor. Sensor resistance value should approximate resistance value given in Fig. 1-39. Replace any malfunctioning sensor located. If no malfunctioning sensor is found, check car wiring.

k. If an ohmmeter is not available, substitute a known good ambient sensor, duct sensor, and then in-car sensor; check operation of system after each substitution. If system still fails to perform satisfactorily, check car wiring.

3. Amplifier Test

CAUTION: Sensor string must be tested before testing amplifier.

a. Place Amplifier switch on Automatic Climate Tester, J-21512, in AMPLIFIER position.

b. Turn Amplifier Control counterclockwise to stop. System and tester meter should go to full air conditioning.

c. Turn Amplifier Control clockwise to stop. System and tester meter should go to full heater.

(NOTE: If tester meter does not vary with variation in Amplifier Control, transducer or electrical circuit to transducer is malfunctioning.)

d. If steps b and c do not result in correct system operation, proceed to step 4.

e. If system operated properly in steps b and c, disconnect Automatic Climate Control Tester and reconnect car wiring harness to amplifier.

f. Disconnect red wire from temperature dial rheostat terminal on amplifier. With wire open, system should go to full air conditioning.

g. Ground red wire. System should go to full heat.

h. If system performed properly in steps f and g replace temperature dial rheostat.

i. If system failed to perform properly in steps f and g, replace amplifier circuit board.

j. If system fails to work properly after replacing amplifier circuit board, check car wiring.

4. Regulated Vacuum Test

(NOTE: Automatic Climate Control Tester, J-21512, should still be plugged in and engine should be running.)

a. Connect a vacuum gage to transducer vacuum input hose. Gage should read above 14 inch Hg. If not, locate and correct vacuum failure.

b. Reconnect vacuum input hose and connect vacuum gage to transducer output fitting, using a length of vacuum hose.

c. Make certain that temperature dial is at 71° setting.

d. Place Amplifier switch on Automatic Climate Control Tester, J-21512, in SENSOR position. Turn sensor switch to MID position and rotate temperature dial until tester meter needle reads on set line. Vacuum gage should read between 3.5 inch Hg. and 7.2 inch Hg. If not, replace transducer.

e. Rotate temperature dial to 65° setting. Vacuum gage should read 1.5 inch Hg. or less. If vacuum reading is lower, turn Sensor switch to A/C position, gage should now read 1.5 inch Hg. or less. If not, replace transducer.

f. Repeat step d.

g. Rotate temperature dial to 85° setting, vacuum gage should read 10 inch Hg. or more. If vacuum reading is lower, turn Sensor switch to HTR position, gage should now read 10 inch Hg. or more. If not, replace transducer. Check car wiring.

h. Rotate temperature dial to 71° setting and place Amplifier switch in AMPLIFIER position. Rotate tester Amplifier control from stop to stop. Output of transducer should vary between 1.5 inch Hg. or less, to 10 inch Hg. or more within 10 seconds. If not, replace transducer.

5. System Vacuum Test

a. Tee in a vacuum gage to any nipple of the master switch, and position vacuum gage so that it can be read from the seat.

b. Set the temperature dial to 71° and start engine. Vacuum gage should read above 14 inch Hg. at idle and stay at this setting throughout the check.

c. Slowly rotate temperature dial to 85°, and then back to 65°. If the temperature dial is rotated too rapidly, the vacuum may drop to 9 inch Hg. or so, but it should return to the original setting. This is a normal condition. However, if a vacuum leak is present, the vacuum reading will drop to 6 inch Hg. or less and remain there.

(NOTE: It is possible that a vacuum leak may show up only at a particular setting of the temperature dial. Therefore, whenever the vacuum drops, immediately stop rotating the dial until you are certain whether a leak is present or whether you were turning the dial too fast.)

d. Rotate temperature dial back to 71° except in OFF position, where there should be no vacuum reading.

e. If a vacuum leak is present, determine when it is present. Then, referring to Fig. 1-132 determine what valves, hoses and vacuum power units are involved to locate leak.

6. Temperature Dial Test with Automatic Climate Control Tester, J-21512.

(NOTE: This test can be made only when the system is operating properly.)

a. Place Amplifier switch in SENSOR position.

b. Place Sensor switch in MID position.

c. Adjust temperature dial until tester meter reads on SET line. Temperature dial should read 71°.

d. If termperature dial does not read 71°, adjust dial as described in Note 15a.

7. Shut off engine and remove Automatic Climate Control Tester from system and connect car wiring harness to amplifier connector.

8. Intermittent Conditions

BACK TO INDEX

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a. Connect the positive lead of an accurate voltmeter to the transducer wire at the transducer connector. Ground the negative lead to the car body.

b. Allow system to operate and stabilize.

c. Tap the sensors, temperature dial and amplifier. A severe rap is necessary. Jiggle wires to the various units.

d. Watch the voltmeter for any sharp variation in the meter reading. Note the operation of the system.

e. If a variation occurs when a unit is tapped, check that unit for loose connections. Repair connections as necessary.

b. Automatic Temperature Control Tester, J-22368-01

1. Preliminary Test

a. Place Transmission in PARK and start engine.

b. Disconnect vacuum hose from power servo vacuum power unit, and seal hose with thumb. System and power servo should go to full air conditioning.

c. Connect a vacuum hose from vacuum supply line to power servo vacuum power unit. System and power servo should go to full heat. Reinstall vacuum hoses.

d. If system and power servo performed properly in steps b and c, proceed to step 3.

e. If power servo performed properly, but system did not, in steps b and c, proceed to step 6.

f. If power servo and system failed to perform properly, proceed to step g.

g. Check power servo and temperature door for binding or other mechanical interference. If no mechanical interference is found, replace power servo unit.

h. If system failed to turn on, proceed to step 2.

2. Source Test

a. Turn off engine if still operating and connect Automatic Temperature Control Tester, J-22368-01.

b. Turn system ON and set temperature dial to 71° setting.

c. With transmission in PARK position, start engine.

d. Place rocker switch on Automatic Temperature Control Tester, J-22368-01 in MANUAL position.

e. Turn voltage knob to SOURCE position.

f. Set manual control knob to 150 position.

g. Tester meter should read battery voltage.

h. If meter does not read battery voltage, check the power supply wires for shorts, grounds or opens. Check for blown fuse. The tester may be used for checking the wiring by turning the voltage knob to PROBE position and using the red probe.

i. If meter read battery voltage in step g, proceed to step 3.

3. Sensor String Test (Opens)

a. Place rocker switch in MANUAL position.

b. Turn voltage knob to SENSOR position.

c. Set manual control knob to 150 position.

d. Tester meter should read battery voltage.

e. If meter read battery voltage in step d, proceed to step 4.

f. If meter did not read battery voltage in step d, visually inspect in-car sensor, replace if apparently malfunctioning, and check operation of system.

g. Check for loose connector at duct sensor and then at ambient sensor. If loose connector is found, repair and check operation of system.

h. If an ohmmeter is available, measure resistance value of ambient sensor, and then in-car sensor. Sensor resistance value should approximate resistance value given in Fig. 1-3. Replace any malfunctioning sensor located. If no malfunctioning sensor is found, check car wiring.

i. If an ohmmeter is not available, substitute a known good ambient sensor, duct sensor, and then in-car sensor; check operation of system after each substitution. If system still fails to perform satisfactorily, check car wiring.

4. Amplifier Test

(NOTE: Sensor string must be tested before testing amplifier.)

a. Place rocker switch in MANUAL position.

b. Turn voltage knob to AMPLIFIER OR CONTROL CAL. position.

c. Turn manual control to MAX. HEAT position.

d. Meter should read from 0 to 4 volts.

e. Turn manual control to MAX. COLD position.

f. Meter should read 8 volts minimum.

g. If steps c through f do not result in correct readings, proceed to step i.

h. If proper readings were achieved in steps c through f, proceed to step 5.

i. Disconnect red wire from temperature dial rheostat terminal. With wire open, system should go to full air conditioning. Meter should read 8 volts minimum.

j. Ground red wire. System should go to full heat, meter should read 0-4 volts.

k. If system performed properly in steps i and j, replace temperature dial rheostat.

l. If system failed to perform properly in steps i and j, replace amplifier circuit board.

m. If system fails to work properly after replacing amplifier circuit board, check car wiring.

5. Transducer Test

a. Place rocker switch in MANUAL position.

b. Turn voltage knob to TRANSDUCER position.

c. Turn manual control to MAX. COLD position.

d. Tester meter should read 8 volts minimum and vacuum gage should read 0-3 inches vacuum. Maximum blower should be achieved.

e. Turn manual control to MAX. HEAT position.

f. Tester meter should read 0-4 volts and vacuum gage should read 9 inches minimum vacuum. Maximum blower should be achieved.

g. If proper readings are not obtained in steps c through f, check wiring to transducer circuit for shorts, grounds or opens. Check for improperly grounded transducer. Replace transducer.

6. System Vacuum Test

a. Tee in a vacuum gage to any nipple of the master switch, and position vacuum gage so that it can be read from the seat.

b. Set the temperature dial to 70° and start engine. Vacuum gage should read above 14 inch Hg. at idle and stay at this setting throughout the check.

BACK TO INDEX

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c. Slowly rotate temperature dial to 85°, and then back to 65°: If the temperature dial is rotated too rapidly, the vacuum may drop to 9 inch Hg. or so, but it should return to the original setting. This is a normal condition. However, if a vacuum leak is present, the vacuum reading will drop to 6 inch Hg. or less and remain there.

(NOTE: It is possible that a vacuum leak may show up only at a particular setting of the temperature dial. Therefore, whenever the vacuum drops, immediately stop rotating the dial until you are certain whether a leak is present or whether you were turning the dial too fast.)

d. Rotate temperature dial back to 71° setting. Vacuum reading should always be above 14 inch Hg., except in OFF position, where there should be no vacuum reading.

e. If a vacuum leak is present, determine when it is present. Then, referring to Fig. 1-132 and Fig. 1-133 determine what valves, hoses and vacuum power units are involved to locate leak.

7. Temperature Dial Test with Automatic Temperature Control Tester, J-22368-01.

a. Place rocker switch in MANUAL position.

b. Set voltage knob to AMPLIFIER OR CONTROL CAL. position.

c. Set manual control to 138 position.

d. Rotate temperature dial until tester meter indicates 6.5 volts.

e. Temperature dial should indicate 75°.

f. If temperature dial does not indicate proper setting, adjust temperature dial as indicated in Note 15a.

8. Operational Test

a. Both systems should be turned ON, the front system should be operating in AUTO. The temperature dials should be st at 75°.

b. Position rocker switch in AUTOMATIC position.

c. Set voltage knob to AMPLIFIER OR CONTROL CAL. position.

d. Set manual control to 150 position.

e. Allow five minutes for systems to stabilize with doors and windows closed.

f. Meter should read 5.5 - 7.5 volts.

g. If improper reading is obtained in step f, check for shorted sensor.

h. If proper reading is achieved in step f, tap sensors and amplifier.

i. If meter needle jumps when a unit is tapped, check that unit for weak connections that will cause an intermittent malfunction in system.

j. If proper reading is achieved in step f, with no movement of the needle in step i and all steps in part steps 1-7 have been completed, system is operating properly.

k. Shut off engine and remove Automatic Temperature Control Tester, J-22368-01 from system. Connect car wiring harness connector to amplifier connector and large vacuum hose to transducer. Install any trim items removed.

c. Temperature Dial Operational Test

(NOTE: This test is performed without the Automatic Temperature Control Tester, J-22368-01, or Automatic Climate Control Tester, J-21512. Although it is less efficient it allows for the tailoring of a system to meet the requirements of an individual owner.)

a. Using masking tape. suspend a thermometer from headliner so that bulb hangs at breath level over front passenger's seat.

b. Suspend a second thermometer at breath level midway between the rear roof outlets.

c. Position auxiliary fan (approximately 24 inch dia. blades) so that air stream is directed towards air intake grille.

d. Close all doors and windows.

e. Set both temperature dials to 75°.

f. With shift lever in PARK position, start engine and operate at 900 rpm.

g. Making certain that all air conditioner outlets are open, adjust as follows:

1. Front end outlets so that air is directed toward doors.

2. Front center outlet so air is directed toward top of front seat.

3. Rear roof outlet diverter doors should be opened.

(NOTE: Outlet air must not be directed toward thermometers.)

h. Allow systems to operate for 25 minutes for stabilization, then record reading from suspended thermometers.

i. If thermometers vary from 75° setting, adjust temperature dials to coincide with nearest thermometer reading, as indicated in Note 15a.

80. Automatic Climate Control Panel

a. Removal

1. Remove rear seat cushion by lifting forward edge and pulling forward.

2. Remove rear seat back by removing two screws along lower edge and lifting assembly off mounting hooks.

3. Remove six screws securing right armrest to trim panel and remove armrest.

4. Remove trim pad from right side panel for access to back of panel.

5. Remove radio controls.

6. Remove electrical connectors from temperature dial and master "ON-OFF" switch.

7. Remove two screws securing control panel to trim pad and remove control panel.

b. Installation

1. Position control panel to trim pad and secure with two screws.

2. Connect electrical connectors at master "ON-OFF" switch and temperature dial.

3. Install radio controls.

4. Reposition trim pad and install in position on quarter panel.

BACK TO INDEX

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5. Position armrest against quarter panel and secure with six screws.
6. Install rear seat back on mounting hooks and secure with two screws.
7. Install rear seat cushion.

81. Air Conditioner Control Panel Disassembly and Assembly

a. Temperature Dial Rheostat Removal

1. Remove control panel as described in Note 57a.
2. Disconnect electrical connector inside arm rest.
3. Remove two screws securing rheostat to control panel and remove rheostat.

b. Temperature Dial Rheostat Installation

1. Position rheostat to control panel and secure with two screws.
2. Connect electrical connector.
3. Install control panel as described in Note 57b.
4. Adjust temperature dial as described in Note 52.

c. Control Switch Removal

1. Remove control panel as described in Note 57a.
2. Disconnect black and yellow hoses from control switch.
3. Remove two screws and remove switch.

d. Control Switch Installation

1. Position switch to control panel and secure with two screws.
2. Connect black and yellow hoses to ports as indicated by color coding dots on switch assembly.
3. Install control panel as described in Note 57b.

82. Amplifier

a. Removal

1. Remove trim panel inside luggage compartment.
2. Remove multiple connector from amplifier terminals.
3. Disconnect red wire at single connector.
4. Remove spring clip securing multiple connector to mounting plate.
5. Remove screw securing amplifier circuit board to mounting plate.

b. Installation

1. Position amplifier circuit board to mounting plate and install screw securing circuit board to mounting plate.
2. Install spring clip securing multiple connector to mounting plate.
3. Connect red wire at single connector.
4. Connect multiple connector to amplifier terminals.
5. Install trim panel inside luggage compartment.

83. In-Car Sensor

a. Removal

1. Snap protective grille off in-car sensor on package shelf inside car.
2. Remove two screws securing sensor to package shelf.
3. Disconnect in-car sensor from electrical connector.
4. Carefully remove in-car sensor.

b. Installation

1. Connect in-car sensor to electrical connector.
2. Position in-car sensor on package shelf.
3. Secure in-car sensor to package shelf with two screws.
4. Snap protective grille over in-car sensor on package shelf.

84. Duct Sensor

a. Removal

1. Remove trim panel inside luggage compartment.
2. Disconnect electrical connector from sensor terminals.
3. Remove two screws securing sensor to right mode door assembly and remove sensor.

b. Installation

1. Position sensor to right mode door assembly and secure with two screws.
2. Connect electrical connector to sensor terminals.
3. Install trim panel inside luggage compartment.

85. Water Control Valve

(NOTE: The water control valve and thermal vacuum valve are serviced as an assembly.)

a. Removal

1. Remove trim panel inside luggage compartment.
2. Pinch off valve inlet and outlet water hoses, Fig. 1-137.
3. Position shallow pan under water control valve to catch any coolant that may spill.
4. Remove clamps securing hoses to valve, and remove water hoses.
5. Remove vacuum hoses from thermal vacuum valve, and remove vacuum hose from water control valve vacuum power unit.
6. Remove horseshoe spring retainer clip securing valve to mounting bracket and remove valve.

b. Installation

1. Position water control valve to mounting bracket and secure with horseshoe spring retainer clip.
2. Install water hoses on valve inlet and outlet fittings and install clamps on hoses.
3. Remove clamps pinching off hoses.
4. Install vacuum hoses on thermal vacuum valve.

BACK TO INDEX

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(NOTE: Yellow striped hose connects to vacuum nipple closest to water outlet fitting.)

5. Connect red striped vacuum hose to water control valve vacuum power unit.
6. Install trim panel inside luggage compartment.
7. Replace any coolant lost.

86. Blower Resistor

a. Removal

1. Remove trim panel inside luggage compartment.
2. Remove multiple connector from blower resistor.
3. Remove single connector from blower resistor.
4. Remove two screws securing blower resistor to bottom of case assembly.
5. Remove blower resistor from bottom of case assembly.

b. Installation

1. Position blower resistor into bottom of case assembly.
2. Secure resistor to case assembly with two screws.
3. Install single connector on blower resistor.
4. Install multiple connector on blower resistor.
5. Install trim panel inside luggage compartment.

87. Blower Motor Assemblies

This procedure applies to both right and left blower motors.

a. Removal

1. Remove trim panel inside luggage compartment.
2. Disconnect double connector at motor to be removed. Connector is located in front of motor, Fig. 1-137.
3. Pull back rubber material from screw heads and remove five screws securing blower motor to blower housing.
4. Remove blower and fan assembly.

b. Installation

1. Position blower motor and fan assembly in blower housing and secure with five screws, and replace rubber insulating material.
2. Connector double connector.
3. Install trim panel inside luggage compartment.

88. Master Switch

a. Removal

1. Remove trim panel inside luggage compartment.
2. Disconnect vacuum hoses from master switch.
3. Disconnect electrical connector from master switch.
4. Remove screw securing master switch mounting bracket to case and remove master switch and mounting bracket.
5. Separate mounting bracket from master switch.

b. Installation

1. Install mounting bracket on master switch.
2. Position master switch mounting bracket to case and install screw securing mounting bracket to case.
3. Connect electrical connector to master switch.
4. Install vacuum hoses to master switch.
5. Install trim panel inside luggage compartment.

89. Power Servo

a. Removal

1. Remove trim panel inside luggage compartment.
2. Disconnect multiple electrical connector from power servo, Fig. 1-137.
3. Disconnect multiple vacuum connector from servo valve.
4. Disconnect vacuum hose from power servo vacuum power unit.
5. Disconnect temperature door link at temperature door arm.
6. Remove two screws securing power servo to case.
7. Remove power servo.

b. Installation

1. Position power servo into opening in case and secure with two screws.
2. Connect vacuum hose to power servo vacuum power unit.
3. Connect multiple vacuum connector to servo valve.
4. Connect multiple electrical connector.
5. Connect and adjust temperature door link – Note 15b.
6. Replace trim panel inside luggage compartment.

90. Power Servo Vacuum Valve

a. Removal

1. Disconnect multiple hose connector.
2. Remove spring clip and one screw securing vacuum valve to power servo.
3. Remove vacuum valve.

b. Installation

1. Position vacuum valve on power servo and secure with one screw and spring clip.
2. Connect multiple hose connector.

91. Mode Door Assemblies

This procedure applies to both right and left mode door assemblies.

a. Removal

1. Remove trim panel inside luggage compartment.
2. Remove duct sensor electrical connector from right mode door assembly only.
3. Remove vacuum hose from mode door vacuum diaphragm.
4. Remove three nuts securing de-fogger duct to outlet grille on package shelf.
5. Loosen clamps securing mode door assembly to blower assembly, heater discharge and air conditioner discharge hoses.

BACK TO INDEX

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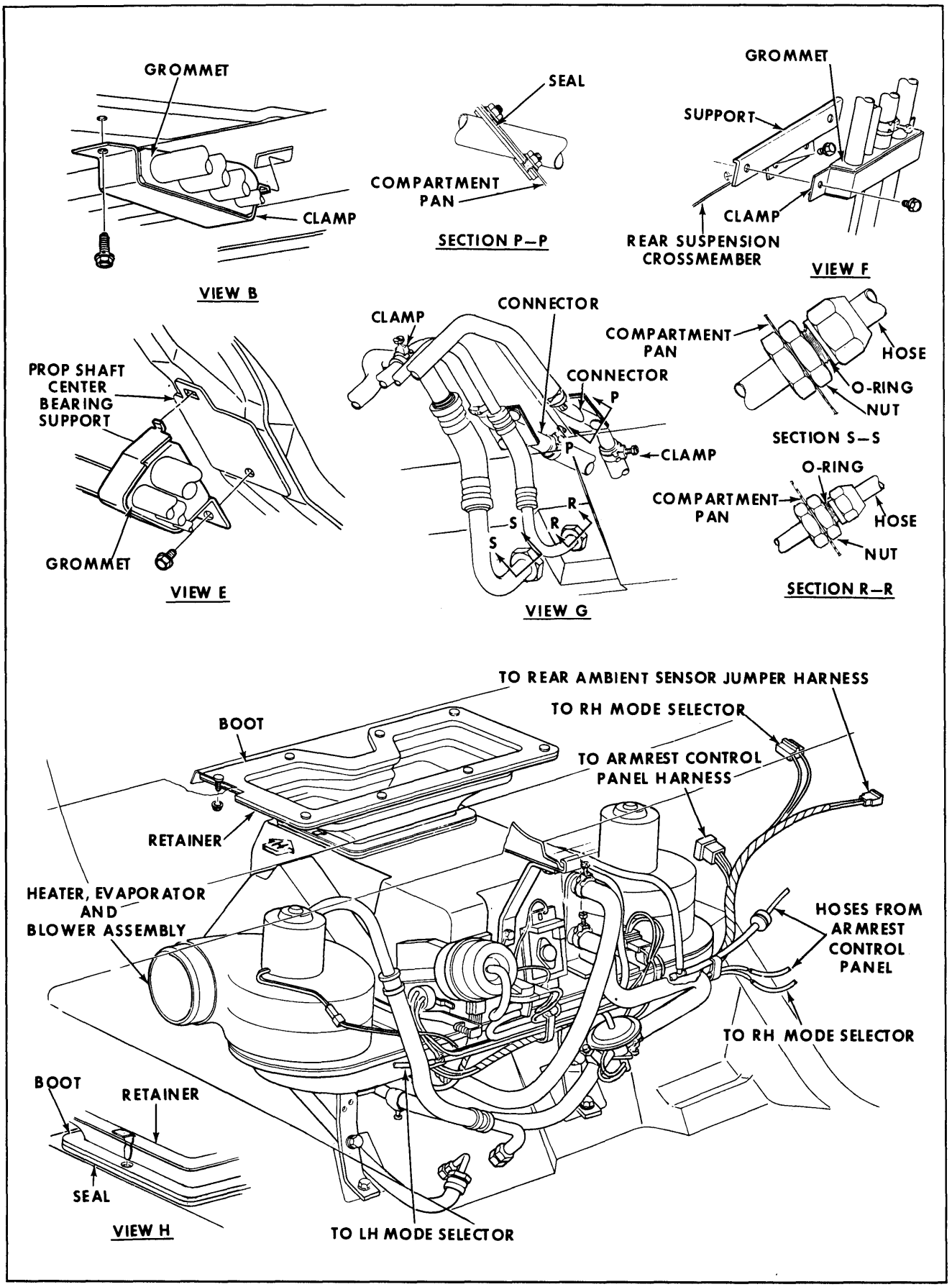


Fig. 1-137 Heater, Evaporator and Blower — Rear Unit

BACK TO INDEX

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6. Slide discharge hoses off of mode door assembly and lift assembly off of blower outlets.

b. Installation

1. Install mode door vacuum hose on diaphragm.
2. Position mode door assembly on blower outlet.
3. Position heater discharge and air conditioner discharge hoses on mode door assembly.
4. Secure mode door assembly on blower assembly by tightening clamp.
5. Secure heater discharge and air conditioner discharge hoses onto mode door assembly by tightening clamps.
6. Position de-fogger ducts to outlet grille on package shelf, retaining with three nuts.
7. Install duct sensor electrical connector into right mode door assembly only.
8. Install trim panel inside luggage compartment.

92. Transducer

a. Removal

1. Remove trim panel inside luggage compartment.
2. Disconnect vacuum hoses from fittings on transducer.
3. Disconnect transducer electrical connector.
4. Remove two screws securing transducer mounting bracket to power servo and remove transducer.

b. Installation

1. Position transducer to power servo and secure with two screws.
2. Connect transducer electrical connector.
3. Connect vacuum hoses to fittings on transducer.

(NOTE: Vacuum hose with smallest I.D. goes on top fitting of transducer.)

4. Replace trim panel inside luggage compartment.

93. Blower Evaporator Assembly

a. Removal

1. Remove trim panel inside luggage compartment.
2. Purge system as described in Note 12.
3. Drain engine cooling system.
4. Raise rear of car and remove clamp securing evaporator drain and remove drain.
5. Disconnect right and left mode door assemblies from blower motors and disconnect tan vacuum hoses.
6. Disconnect ambient air hoses from blower evaporator assembly.
7. Disconnect ambient and duct sensor leads.
8. Disconnect heater supply and return hoses, air conditioner high and low pressure hoses, and vacuum supply hose at connector where they enter luggage compartment below blower evaporator assembly.
9. Disconnect six way electrical connector from body wiring at right side of car.
10. Disconnect yellow and black vacuum hoses at right side of car.
11. Unsnap return air boot from blower evaporator assembly.
12. Remove screw securing bracket to package shelf.
13. Remove four screws securing brackets to floor pan.
14. Lift blower evaporator assembly out of luggage compartment.

b. Installation

1. Position blower evaporator assembly in luggage compartment.
2. Connect right and left mode door assemblies to blower evaporator outlets.
3. Connect tan vacuum hoses.
4. Connect return air boot to blower evaporator case.
5. Connect yellow and black vacuum hoses at right side.
6. Connect six-way electrical connector at right side.
7. Connect heater supply and return hoses, air conditioner high and low pressure hoses, and vacuum hose at connectors under blower evaporator assembly. Refer to Fig. 1-137. Recover low pressure hose with insulation.
8. Connect ambient and duct sensor leads.
9. Connect ambient air hoses to blower evaporator.
10. Secure lower brackets to floor pan with four cap screws.
11. Secure upper bracket to package shelf with screw.
12. Raise rear of car and install evaporator drain assembly.
13. Fill engine cooling system.
14. Evacuate system as described in Note 12.
15. Charge system as described in Note 12.
16. Replace trim panel inside luggage compartment.

94. POA Suction Throttling Valve

a. Removal

1. Remove blower evaporator assembly as described in Note 70a.
2. Remove screw securing suction throttling valve clamp to case assembly.
3. Disconnect equalizer line.
4. Disconnect low pressure line form suction throttling valve.
5. Disconnect suction throttling valve from evaporator outlet pipe.

b. Installation

1. Connect suction throttling valve to evaporator outlet pipe.
2. Connect low pressure line to suction throttling valve, and cover with insulation.
3. Connect equalizer line to suction throttling valve.
4. Secure suction throttling valve to case assembly with clip and one screw.
5. Install blower evaporator assembly as described in Note 70b.

BACK TO INDEX

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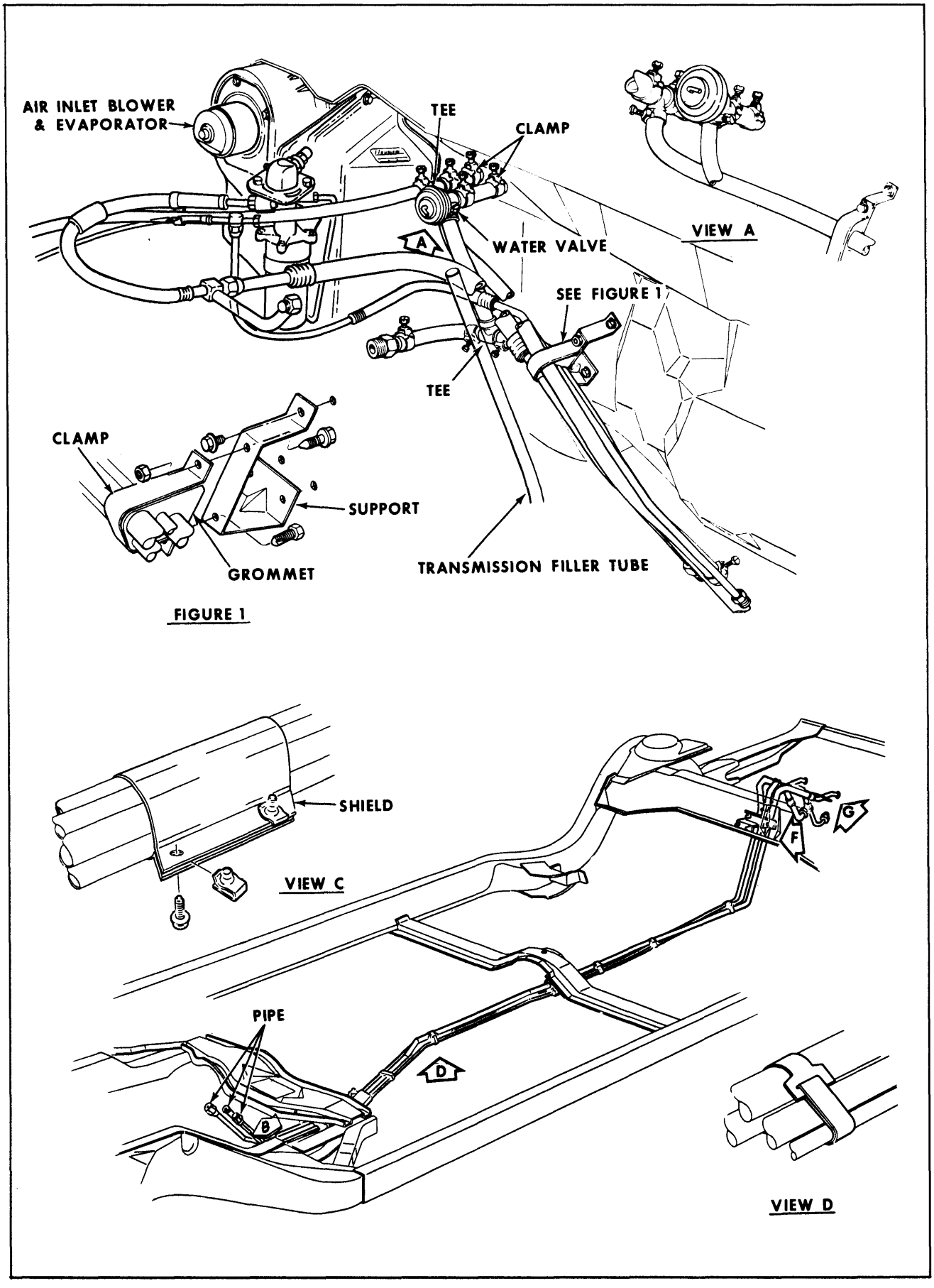


Fig. 1-138 Refrigerant and Coolant Lines - 75 Series

BACK TO INDEX

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95. Evaporator Core

a. Removal

1. Remove blower evaporator assembly as described in Note 70a.
2. Remove 29 screws and 4 nuts holding evaporator case together and remove bottom of case.
3. Remove screw and clamp securing high pressure line to bottom of case assembly.
4. Disconnect suction throttling valve from evaporator outlet pipe.
5. Disconnect equalizer line from suction throttling valve.
6. Remove ambient air inlet fittings from case.
7. Remove four screws on top of case securing evaporator core to case and remove evaporator core from case.
8. Remove expansion valve from evaporator core as described in Note 73a.

b. Installation

1. Install expansion valve to evaporator core as described in Note 73b.
2. Position evaporator core in case assembly and secure with four screws.
3. Install ambient air inlet fittings on case.
4. Connect suction throttling valve to evaporator outlet pipe.
5. Connect equalizer line to suction throttling valve.
6. Position bottom of case on assembly and secure with 29 screws and 4 nuts.
7. Secure high pressure line to bottom of case with clamp and screw.
8. Install blower evaporator assembly as described in Note 70b.

96. Expansion Valve

a. Removal

1. Remove blower evaporator assembly as described in Note 70a.
2. Remove evaporator core assembly as described in Note 72a.
3. Remove power element bulb from evaporator outlet pipe.
4. Disconnect equalizer line from POA suction throttling valve.
5. Disconnect expansion valve from evaporator inlet.

b. Installation

1. Connect expansion valve to evaporator inlet.
2. Connect equalizer line to suction throttling valve.
3. Position power element bulb on evaporator outlet and secure.
4. Replace evaporator core assembly as described in Note 72b.
5. Replace blower evaporator assembly as described in Note 70b.

97. Heater Core

a. Removal

1. Remove blower evaporator assembly as described in Note 70a.
2. Remove inlet and outlet hoses from heater inlet and outlet pipes.
3. Remove 29 screws and 4 nuts securing evaporator case together.
4. Remove clamp and screw securing high pressure line to bottom of case.
5. Remove sealing grommet around heater inlet and outlet pipes.
6. Remove 6 screws securing temperature door baffle to case and remove baffle.
7. Remove 6 screws, 3 each side of case, securing heater core and baffle to case.
8. Lift heater core and baffle from case.
9. Remove 4 screws securing baffle to heater core and remove baffle.
10. Remove retainers from heater core.

b. Installation

1. Position retainers to heater core and secure baffle to retainers with 4 screws.
2. Position heater core in case and secure with 6 screws, 3 each side.
3. Install temperature door baffle.
4. Seal hole around heater inlet and outlet pipes with sealing grommet.
5. Position bottom of case on assembly and secure with 29 screws and 4 nuts.
6. Secure high pressure line to bottom of case with clamp and screw.
7. Install inlet and outlet hoses to heater core pipes.
8. Install blower evaporator assembly as described in Note 70b.

BACK TO INDEX

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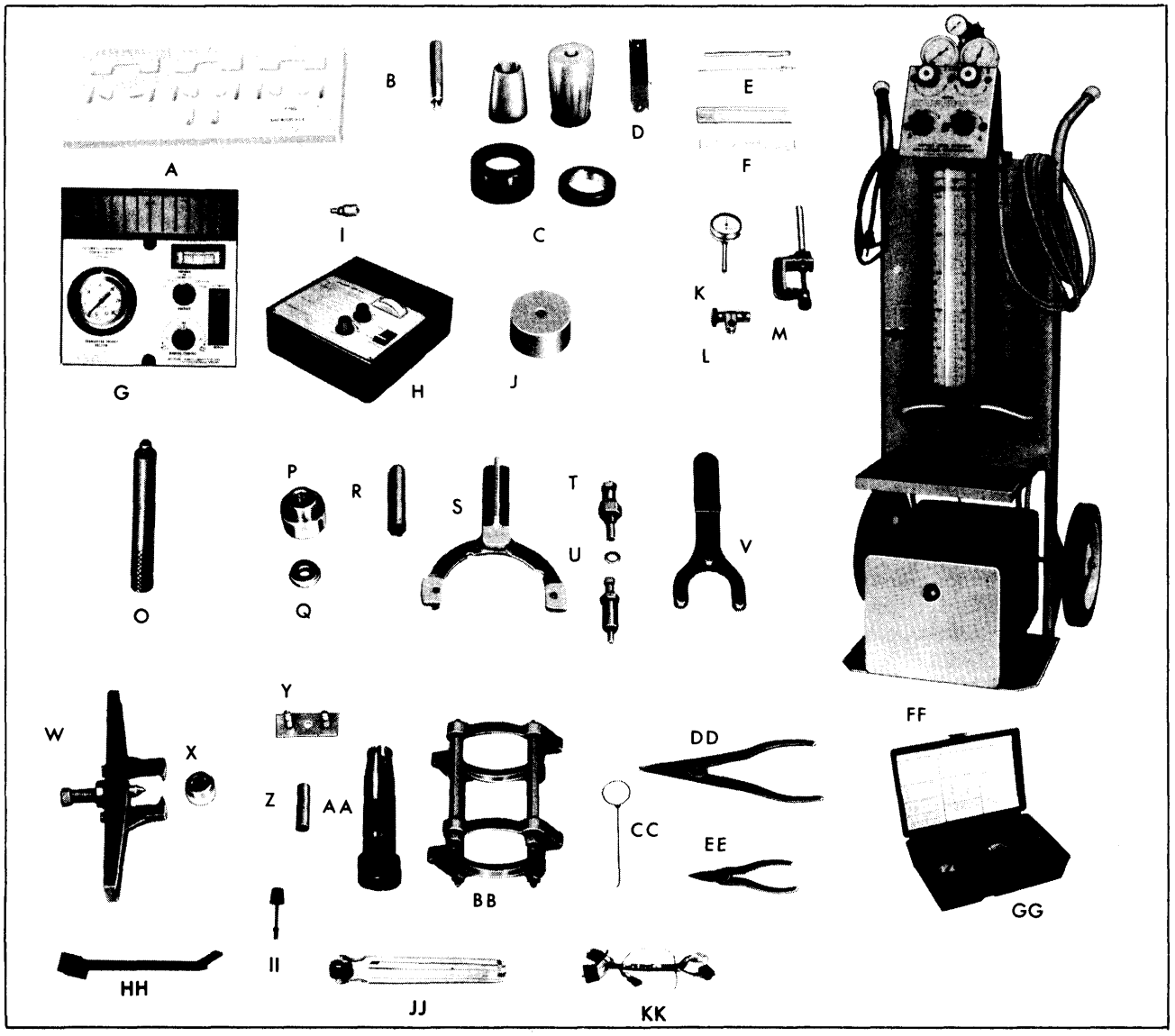


Fig. 1-139 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-9402	Parts Tray	T	J-9480	Clutch Plate and Hub Installer
B	J-9432	Needle Bearing Installer	U	J-9401	Clutch Plate and Hub Remover
C	J-24608	Teflon Piston Ring Tools	V	J-9403	Clutch Hub Holding Tool
D	J-21530	Temperature Dial Adjuster	W	J-8433	Pulley Puller
E	J-22555	Thermometer	X	J-9395	Puller Pilot
F	J-6076	Humidicator	Y	J-9625	Test Plate
G	J-21512	A/C Tester–75 Series	Z	J-9399	9/16" Thin Wall Socket
H	J-22368-01	ATC Tester–75 Series	AA	J-23128	Seal Seat Remover/Installer
I	J-5420	Gage Adapter - Low - 7/16-20	BB	J-9397	Compressor Fixture
	J-25498	- High - 3/8-24	CC	J-5139	Oil Pick-Up Tube Remover
J	J-21352	Internal Assembly Support	DD	J-6435	Snap Ring Pliers (#26)
K	J-8001-3	Dial Indicator	EE	J-5403	Snap Ring Pliers (#21)
L	J-8001-2	Sleeve	FF	J-23500	Charging Station
M	J-8001-1	Clamp	GG	J-23678-01	A/C Tester
O	J-8092	Universal Handle	HH	J-24182-1	Valve Capsule Remover
P	J-9398	Pulley Bearing Remover	II	J-24182-2	Valve Core Remover
Q	J-9481	Pulley and Bearing Installer	JJ	J-24182-3	Pick-Up Tube Installer
R	J-9392	Seal Remover and Installer	KK	J-24774	Harness Adapter
S	J-9396	Holding Fixture			

BACK TO INDEX

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TORQUE SPECIFICATIONS

Material No.	Application	Size	Torque
300-M	Connector Shell Assembly Retaining Screws	1/4-20	10
Special	Evaporator Gage Valve Core	–	30 ounce in.
Aluminum	Evaporator Inlet Connection	3/4-18	18
Aluminum	Evaporator Outlet Connection	1-1/16-16	31
Special	Liquid Bleed Valve Core	–	30 ounce in.
Aluminum	Liquid Bleed Line Connection	7/16-24	30*
Steel	Liquid Line to VIR	5/8-18	12
Steel	Sight Glass Retaining Nut	5/8-18	23
Steel	Suction Line to ~~VIR~~	1-1/16-18	31
300-M	Receiver Shell Mounting Screws	1/4-20	10
300-M	POA and X-Valve Retaining Screws	1/4-20	30*
300-M	Compressor Mounting Brackets to Engine	3/8-16	40
	Compressor Mounting Bracket to Compressor		
300-M	Front	5/16-24	25
300-M	Rear	3/8-16	40
6010-M	Programmer to Heater Case Screws	10-16 TS	13*
6010-M	Heater Case to Cowl Screws - L.H.	10-16 TS	13*
6010-M	Screw - R.H.	1/4-14 TS	13*
284-M	Nuts - Engine Side	1/4-20	65*
6010-M	Defroster Nozzle Screw	10-16 TS	13*
6010-M	Vacuum Storage Tank (Trailer Tow)	1/4-14 TS	60*
6010-M	Ambient Sensor and Thermal Limiter Fuse Screws	10-16 TS	13*
6010-M	Auto Relay to Evaporator Screws	10-16 TS	13*
6010-M	Evaporator to Cowl Screws.	1/4-14 TS	60*
286-M	Condenser to Radiator Cradle Nuts	5/16-18	10
280-M	Refrigerant Hose Manifold to Compressor Screw.	3/8-24	30

* Inch Pounds

BACK TO INDEX

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GENERAL DESCRIPTION

A swept torque-box perimeter type frame, Fig. 2-1, is used on "C" series Cadillac automobiles. The frame is of fully boxed construction throughout its entire length. It encircles the passenger compartment with heavy side members, permitting a low front floor with adequate seat height. This frame design also allows a small floor tunnel, and simplifies propeller shaft arrangement.

The forward portion of the front side rails (frame horns) are of heavy gage steel to provide a rigid mounting for the front bumper and its Energy Absorbing Devices and to withstand loads resulting from a 5 mph impact. The front cross member is recessed to allow space for bumper displacement during such impact. The front suspension tie struts are fastened directly to this cross member as is the center radiator cradle mount.

A full frame cross member Fig. 2-1, is used at the rear of the transmission. The rear engine mount is fastened to the cross member.

A center cross member is provided on the frames on Fleetwood Seventy-Fives and the Commercial Chassis to support the center bearing of the two-piece propeller shaft used on these models. This center cross member is located between the number 3 and number 4 body mounting locations.

The perimeter type frame used on the Commercial Chassis is similar to the passenger car frame; however, it has heavier construction features and incorporates a lower rear kick-up to meet the requirements of the flat floors used on commercial vehicles.

Eldorado

The Eldorado frame, Fig. 2-2, is similar to that of other styles in that it is a swept torque-box perimeter type of fully boxed construction. Front bumper mounting is identical to that of other styles but since tie struts are not used in the suspension system, the front cross member is used as a fastening location for radiator cradle mounts only.

A detachable cross member is located behind the engine and transmission assembly to mount the torsion bars for the front suspension.

Body to frame cross rods are used in the rear axle area on Eldorados to restrain relative lateral motion. This restraint system contributes to rolling smoothness, Fig. 2-3.

The slide-in body castings are connected to stamped brackets at the upper shock absorber mounts with cross rods. It is important that the rubber insulators are properly positioned for fuel line protection, Fig. 2-3.

Installation of the cross rods is described in Note 3.

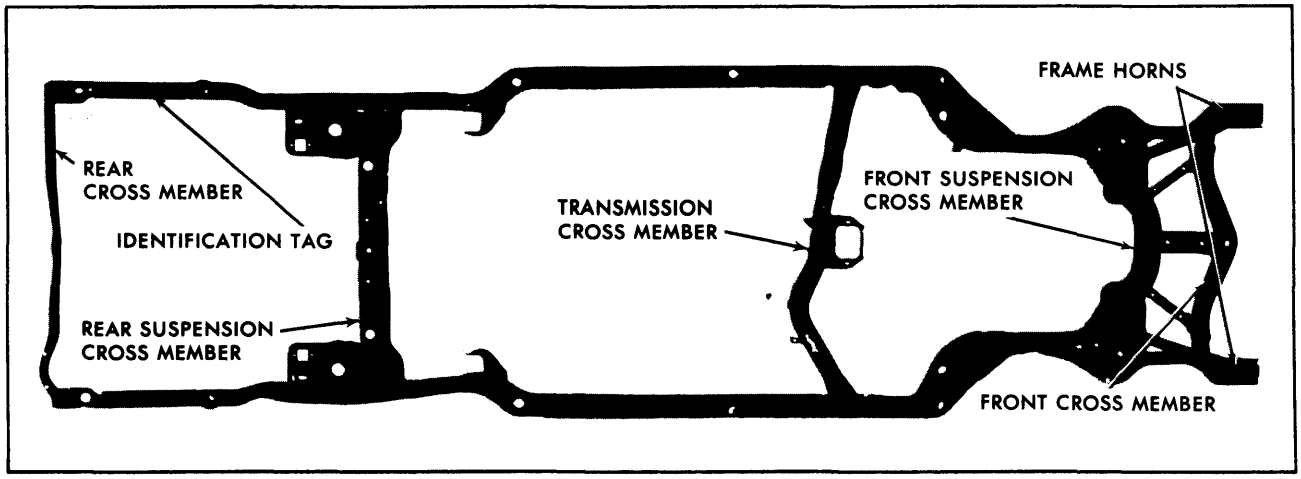


Fig. 2-1 Frame (Except Eldorado)

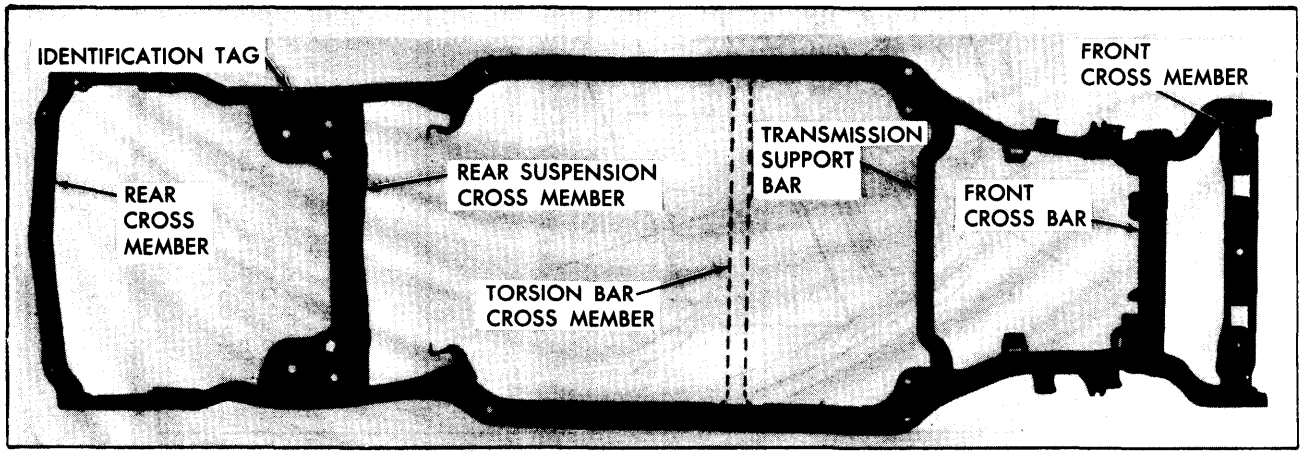


Fig. 2-2 Eldorado Frame

BACK TO INDEX

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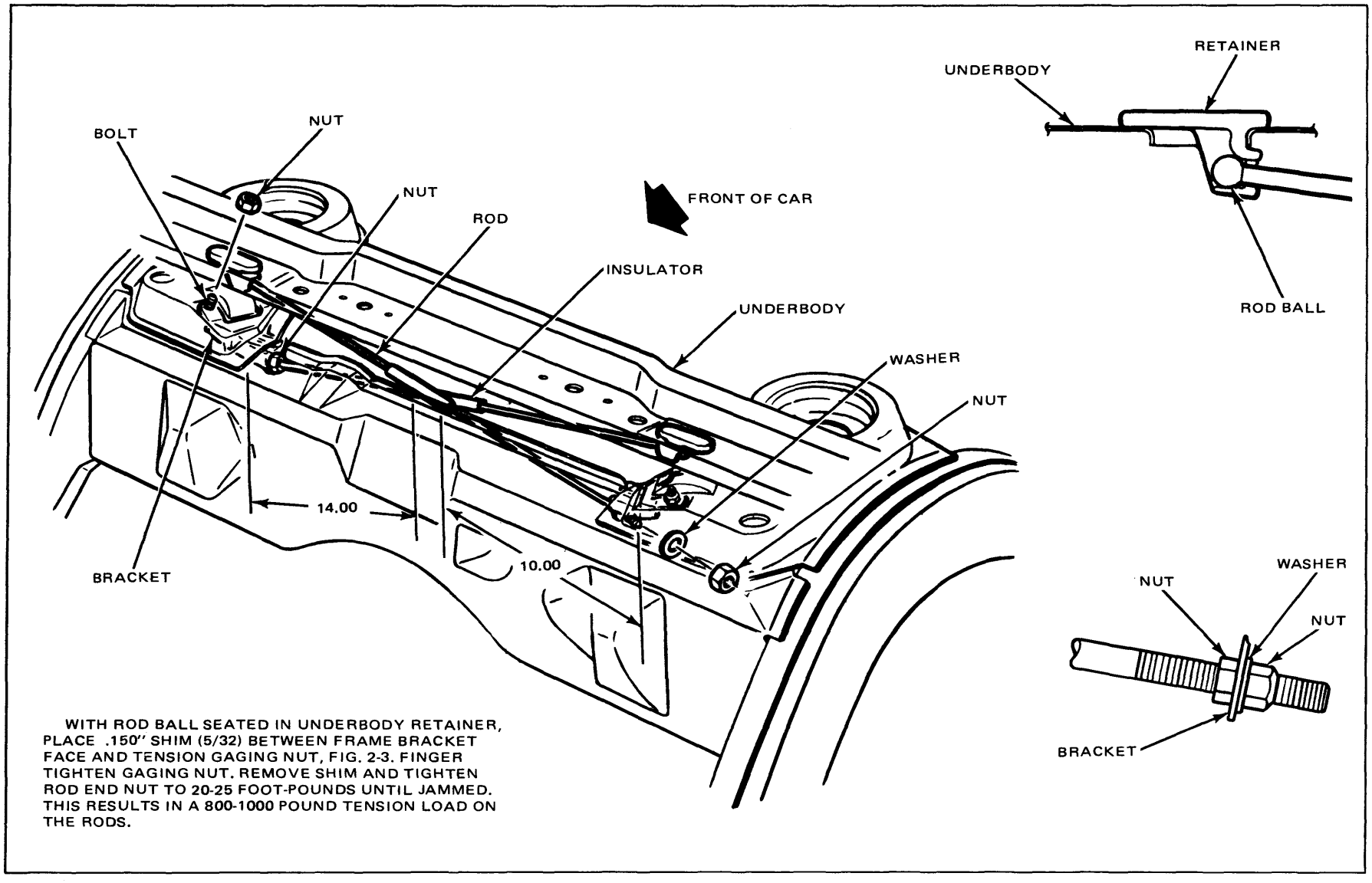
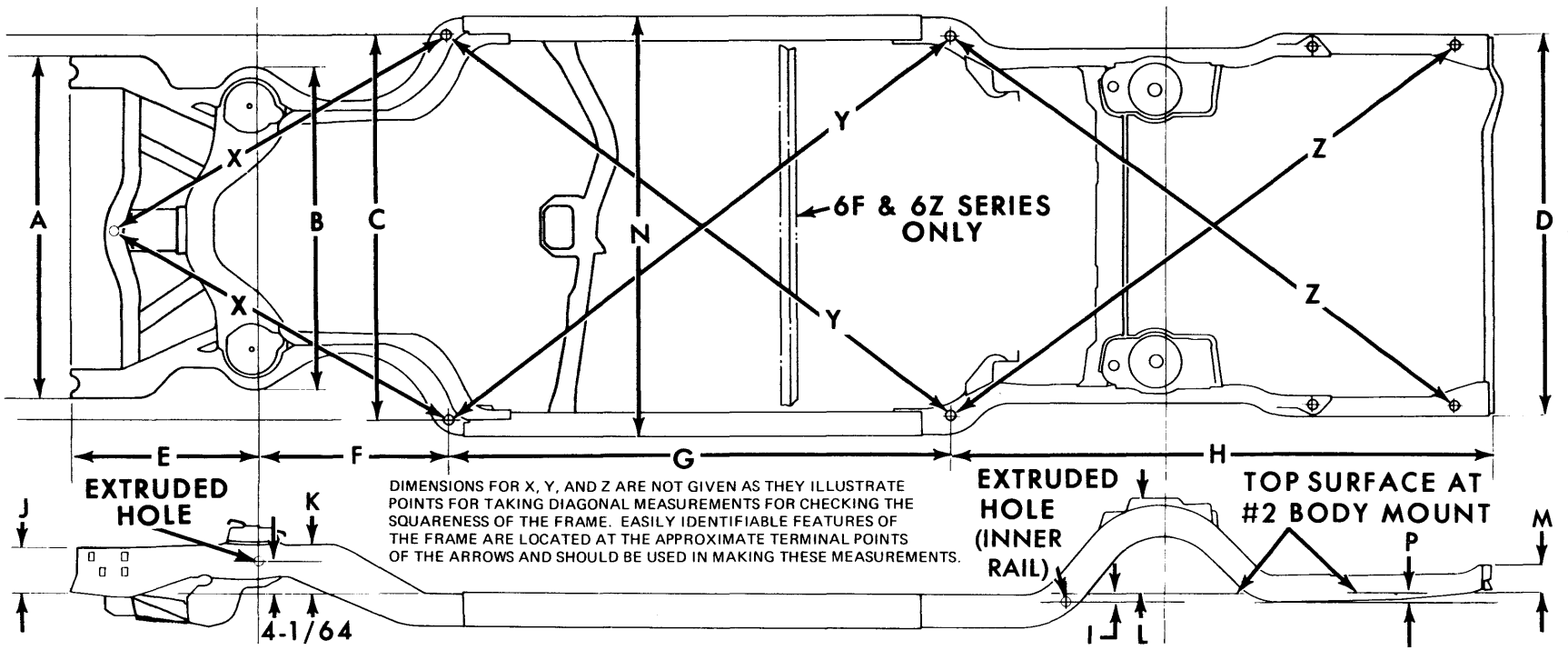


Fig. 2-3 Body to Frame Cross Rods

BACK TO INDEX

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SERIES	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P
DEVILLE & CALAIS	47-13/64	46-13/64	55-1/8	54-25/32	25-23/32	27-15/32	72-5/64	77-3/4	11/16	5-39/64	7-1/32	13-1/2	4	59-21/32	
FLEETWOOD SIXTY SPECIAL	47-13/64	46-13/64	55-1/8	54-25/32	25-23/32	27-15/32	75-5/64	77-3/4	11/16	5-39/64	7-1/32	13-1/2	4	59-21/32	
FLEETWOOOD SEVENTY-FIVE	47-13/64	46-13/64	55-1/8	54-25/32	25-23/32	27-15/32	93-37/64	77-3/4	11/16	5-39/64	7-1/32	13-1/2	4	59-21/32	
COMMERCIAL	47-13/64	46-13/64	55-1/8	54-1/2	25-23/32	27-15/32	101-13/32	74-1/4		5-39/64	7-1/32	6-23/32	2-15/32	62-11/16	11/16

Fig. 2-4 Frame Checking Points (Except Eldorado)

BACK TO INDEX

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SERVICE INFORMATION

WARNING: IF EQUIPPED WITH AIR CUSHION RESTRAINT SYSTEM DO NOT ATTEMPT ANY REPAIR OR REMOVAL OF ANY PORTION OF THE FRAME WHICH WOULD REQUIRE REMOVAL OR DISCONNECTING OF THE BUMPER IMPULSE DETECTOR UNTIL THE DISCONNECTION PROCEDURE IS COMPLETED. THIS PROCEDURE MUST BE FOLLOWED TO PREVENT ACCIDENTAL DEPLOYMENT OF THE SYSTEM WHICH COULD RESULT IN PERSONAL INJURY AND/OR DAMAGE TO THE SYSTEM'S COMPONENTS. IN ADDITION, CARE MUST BE EXERCISED TO NEVER BUMP OR STRIKE THE BUMPER IMPULSE DETECTOR IN A MANNER WHICH COULD CAUSE INADVERTENT DEPLOYMENT OR IMPROPER OPERATION OF THE SYSTEM.

A.C.R.S. DISCONNECTION PROCEDURE

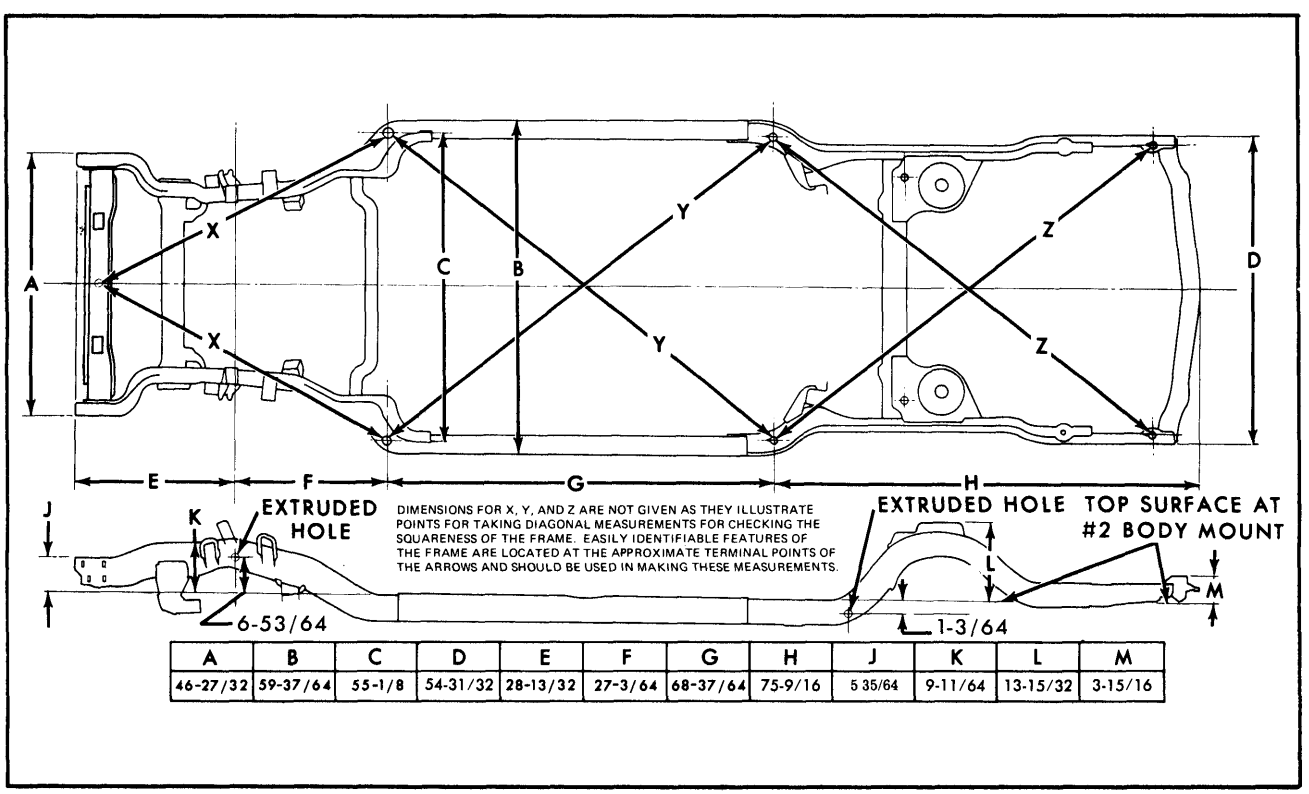
Turn ignition switch to "LOCK" position. Disconnect the negative battery cable from the battery and tape end.

1. Checking Frame for Twist

1. Place car on section of level floor, and inflate tires to proper pressure.
2. Measure distance from top of extreme front end of left side rail to floor. Repeat measurement for right side rail.
3. If front ends of right and left side rails are not the same distance from floor, raise low side rail with a jack until distances are equal.
4. Measure distance from extreme rear end of top of left rear side rail to floor. Repeat for right side rail.

2. Checking Frame Dimensions

Refer to frame checking locations, Fig. 2-4 or 2-5. The car should be on a flat, level floor to assure accurate measurements when either of the following methods are used.



A	B	C	D	E	F	G	H	J	K	L	M
46-27/32	59-37/64	55-1/8	54-31/32	28-13/32	27-3/64	68-37/64	75-9/16	5 35/64	9-11/64	13-15/32	3-15/16

Fig. 2-5 Frame Checking Points - Eldorado

BACK TO INDEX

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The easiest and most accurate method of checking frame dimensions is by use of tram gages. When using tram gages, be sure to keep the gage cross bar level to insure accuracy in all measurements.

The "plumb bob" method may be used for measuring frame dimensions if tram gages are not available. Using this method, it is only necessary to have a piece of cord attached to an ordinary surveyor's plumb bob. When measuring the distance between two points, the free end of the cord should be placed at one of the points and a mark made on the floor exactly under the plumb bob. This operation should be repeated at the other point, and the distance between chalk marks on the floor may be easily measured.

3. Body Cross Rod Installation — Eldorado

With rod ball seated in underbody retainer, place .150" shim (5/32") between frame bracket face and tension gaging nut, Fig. 2-3. Finger tighten gaging nut. Remove shim and tighten rod end nut to 20-25 foot-pounds until jammed. This results in a 800-1,000 pound tension load on the rods.

GENERAL DESCRIPTION

Body Mounts

Locations of the body mount holes on all cars are shown in Fig. 2-6. Cross sectional views of the parts required for installation of body mounts showing the order of assembly also appear in Fig. 2-6. The code letters in the chart and their corresponding cross sections indicate the installation required at the body mount locations for each body style.

SERVICE INFORMATION

4. Body Mounts — #1 through #3a. — Except Eldorado

(Note: Perform procedure exactly as specified regardless of whether all or only one of these mounts is to be replaced, or damage to sheet metal or other components could result.)

a. Removal

1. Disconnect negative battery cable.
2. Raise car.
3. Remove screws securing wheelhousing splash shields to bumper and frame on each side of car.
4. Remove bolts and nuts securing radiator cradle cross rods to frame horns and make sure rods are out of way.
5. On limousines and Commercial Chassis, remove nut, two grommets, spacer, and two retainers securing each support rod to bumper outer end support brackets.
6. Remove two screws securing power steering gear to frame and loosen third screw. Loosen pinch bolt at flex coupling.
7. Remove mounting bolts (and pads if necessary) from all three radiator cradle mounts.
8. Remove mounting bolts and lower pads from all #1 through #5 body mount locations. Store pads and bolts so they can be identified for reinstallation in same locations.

NOTE: See Fig. 2-6 to determine which locations are applicable to body style being worked on.)

9. Place jack stands under body side rails near the #4 locations.
10. Lower chassis until separation between body and frame is barely sufficient to slip out upper pads to be replaced.

CAUTION: Do not separate body and frame more than necessary as damage to sheet metal and other components could result.

11. Remove all upper pads that require replacement.

b. Installation

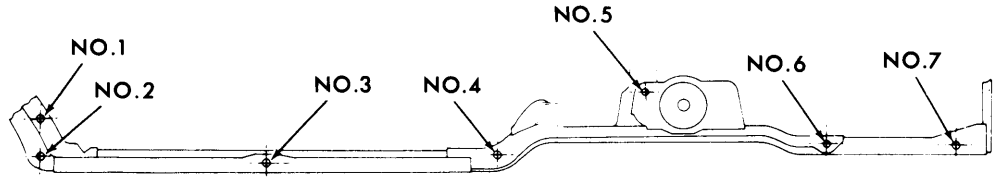
1. Install new upper pads as required. Use shims (if any) found on disassembly.
2. Raise chassis until body is lifted from jack stands. Attempt to rotate upper pads with fingers. If any pad can be moved, separate frame and body and add shims as required.
3. Remove jack stands.
4. Install mounting bolts and lower pads at all applicable locations from front of car through #5 mount. Tighten all bolts uniformly to 55 foot-pounds.
5. Position steering gear and secure to frame with three screws, tightening to 55 foot-pounds. Tighten flex coupling pinch bolt to 30 foot-pounds.

CAUTION: These fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. Each must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

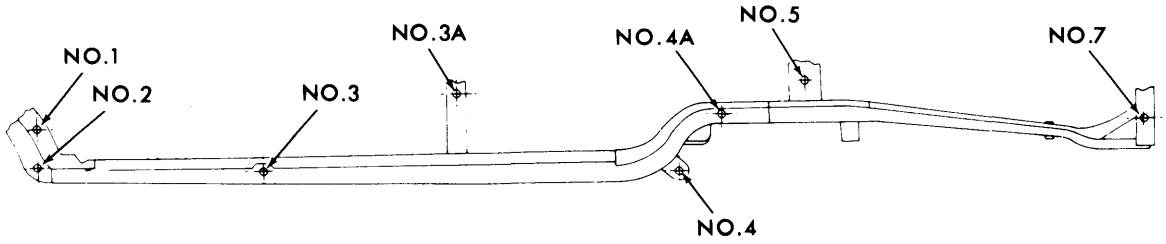
6. On Limousines and Commercial Chassis, install

BACK TO INDEX

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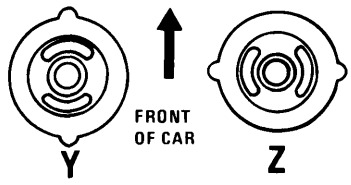


ALL MODELS EXCEPT COMMERCIAL CHASSIS

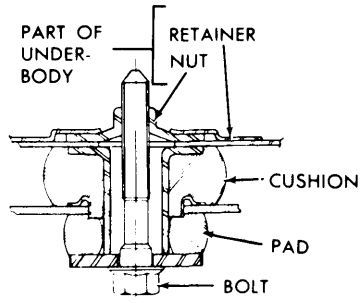


COMMERCIAL CHASSIS

A SPECIAL SELF-TAPPING BODY-TO-FRAME BOLT, HAVING A "TAP TIGHT THREAD," IS RELEASED FOR SERVICE.



DIRECTIONAL MOUNT



BODY MOUNT

ALL BOLTS	SIZE	TIGHTEN TO
	7/16-14	45-60 FT. LBS.

* No rebound pad used on
Brougham #2 position
Fleetwood 75 #2 position & #6 position
Eldorado #1 position
However bolt with large washer is used to retain body to frame in case of impact.
Exception: #6 position on Fleetwood 75 where no bolt or washer is used.

★Washer used at #2 body mounts on Eldorado Coupe (with Air Cushion Restraint System)

★ #3 body mounts used on Eldorado convertible only.

★ Directional mounts (Y or Z) used at the following positions must have locating ribs positioned as follows:

CALAIS - DEVILLE
#1 position - Cross car (Z)
#3 position - Front to rear (Y)
#4 position - Front to rear (Y)
#5 position - Cross car (Z)
FLEETWOOD 75
#3 position - cross car (Z)
ELDORADO
#2 position - Front to rear (Y)
#7 position - Cross car (Z)

Fig. 2-6 Body Mounts and Locations

BACK TO INDEX

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two retainers, one spacer, two grommets, and nut securing each support rod to each bumper outer end support bracket.

7. Install three radiator cradle mounts.
8. Secure radiator cradle cross rods to frame horns.
9. Secure wheelhousing splash shields to frame and to tab on bumper lower outer ends.
10. Lower car.
11. Install negative battery cable, tightening screw to 70 inch-pounds.

5. Body Mounts — #3 through #7 Locations, Left or Right — Except Eldorado

(NOTE: Use the identical procedure including loosening and removal of all fasteners described below regardless of whether all or only one of these body mounts is to be replaced, or visible damage to sheet metal or other components could result.)

a. Removal

1. Raise car.
2. Remove bolts, flat washers, and nuts securing each rear bumper lower mounting bracket to frame.
3. Remove mounting studs and lower pads from all #3 through #7 body mounts using access holes in underside of frame. Store bolts and pads so that they can be reinstalled at same location.
4. Loosen but do not remove mounting bolts at both #1 locations and both #2 locations.
5. Place jack stands under reinforced portion of underbody near #4 mount locations.
6. Lower chassis until separation between body and frame is barely sufficient to slip out all upper pads to be replaced.

CAUTION: If frame and body are separated more than necessary, risk of visible sheet metal damage is greatly increased.

7. Remove any upper pads requiring replacement.

b. Installation

1. Position new upper pads at all locations requiring pad replacement. Install same shims (if any) found on disassembly between pad and frame.
2. Raise chassis until body is lifted from jack stands. Attempt to rotate all upper pads with fingers. If any pads can be moved, lower chassis and install shims between pad(s) and frame.
3. Remove jack stands.
4. Tighten mounting bolts at #1 and #2 locations to 55 foot-pounds.

See fastener CAUTION in Note 4B.

5. Install lower pads and mounting bolts at same locations as found on disassembly, using new pads and bolts as necessary. Tighten mounting bolts to 55 foot-pounds.

See fastener CAUTION in Note 4B.

(NOTE: Make sure torques on all mounting bolts are even, or rough ride could result.)

6. Align rear bumper lower mounting brackets on frame, install nuts, bolts and flat washers securing each mounting bracket to frame, and tighten to 80 foot-pounds.
7. Lower car.

6. Eldorado Body Mounts — #1 or #2 Locations (Left or Right)

(NOTE: Use the identical procedure including loosening and removal of all fasteners described below regardless of whether all or only one of these body mounts is to be replaced, or visible damage to sheet metal components could result.)

a. Removal

1. Disconnect negative battery cable and raise car.
2. Remove radiator cradle mounts from frame front cross member.
3. Remove nut, two grommets, spacer, and two retainers securing each support rod to bumper outer end support brackets.
4. Remove screw and washer securing each wheelhousing splash shield to frame.
5. Remove bolts and body mount lower pads from #1, #2, and #3 locations on each side of car. Loosen body mount bolt at each #4 location.
6. Place jack stands under body side rails approximately midway between #1 body mount and torsion bar cross member.
7. Lower frame carefully until separation between frame and body is barely sufficient to slip out all upper pads to be removed.

See body mount CAUTION in Note 4A.

b. Installation

1. Install new upper pads in all #1 and #2 locations requiring mount replacement. Install same shims found on disassembly.

(NOTE: When installed, pad must be rotated so that two crescent-shaped slits in undersides of #1 and #2 mounts near spacer tube are in a "fore and aft" orientation.)

2. Make sure upper pads at both #3 locations are in position and raise frame until it is supporting body. Recheck all #1, #2, and #3 upper pads to make sure holes line up with mounting holes in frame. Attempt to rotate upper pads. If any pads can be moved, lower chassis and install additional shims.
3. Install lower pad and mounting bolt assemblies at all #1, #2, and #3 locations. Tighten mounting bolts to 55 foot-pounds. Make sure torques are even or rough ride can result.

See fastener CAUTION in Note 4B.

4. Tighten mounting bolts at #4 locations to 55 foot-pounds.

See fastener CAUTION in Note 4B.

5. Secure wheelhousing splash shields to their respective frame rails with one screw and washer each.
6. Install radiator cradle mounts.

BACK TO INDEX
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7. Install support rods in mounting brackets at outer ends of front bumper.

8. Install negative battery cable tightening to 70 inch-pounds.

7. Eldorado Body Mounts — #3 through #7 Locations, Left or Right

(NOTE: Use the identical procedure including loosening and removal of all fasteners described below regardless of whether all or only one of these body mounts is to be replaced, or visible damage to sheet metal or other components could result.)

a. Removal

1. Raise car.

2. Remove two bolts, four flat washers, and two nuts securing each rear bumper lower mounting bracket to frame.

3. Remove mounting studs and lower pads from all #3 through #7 body mounts (ten total) using access holes in underside of frame. Store bolts and pads so that they can be reinstalled at same location.

4. Loosen but do not remove mounting bolts at both #1 locations and both #2 locations.

5. Place jack stands under reinforced portion of underbody forward of each rear lower control arm bracket and inboard of frame side rails.

6. Lower chassis until separation between body and frame is barely sufficient to slip out all upper pads to be replaced.

See body mount CAUTION in Note 4A.

7. Remove any upper pads requiring replacement.

b. Installation

1. Position new upper pads at all locations requiring pad replacement. Install same shims (if any) found on disassembly between pad and frame.

(NOTE: If replacing pads at either #4 location or either #7 location, pads require specific orientation. Two crescent-shaped slots appear on underside of pad near spacer tube. At #4 locations pads must be installed so that slots are in fore and aft position. At #7 locations, slots must be in lateral, i.e., cross-car, position.)

2. Raise chassis until body is lifted from jack stands. Attempt to rotate all upper pads with fingers. If any pads can be moved, lower chassis and install shims between pad(s) and frame.

3. Remove jack stands.

4. Tighten mounting bolts at #1 and #2 locations to 55 foot-pounds.

See fastener CAUTION in Note 4B.

5. Install lower pads and mounting bolts at same #3, #4, #5, #6, and #7 locations as found on disassembly, using new pads and bolts as necessary. Tighten mounting bolts to 55 foot-pounds.

See fastener CAUTION in Note 4B.

(NOTE: Make sure torques on all mount bolts are even, or rough ride could result.)

6. Align rear bumper lower mounting brackets on frame, install two nuts and bolts and four flat washers securing each mounting bracket to frame, and tighten to 80 foot-pounds.

See fastener CAUTION in Note 4B.

7. Lower car and connect negative battery cable, tightening to 70 inch-pounds.

BACK TO INDEX

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TABLE OF CONTENTS

Subject	Page No.
Front Suspension	3-2
Front Suspension—Eldorado	3-27
Front Wheel Drive	3-45

BACK TO INDEX

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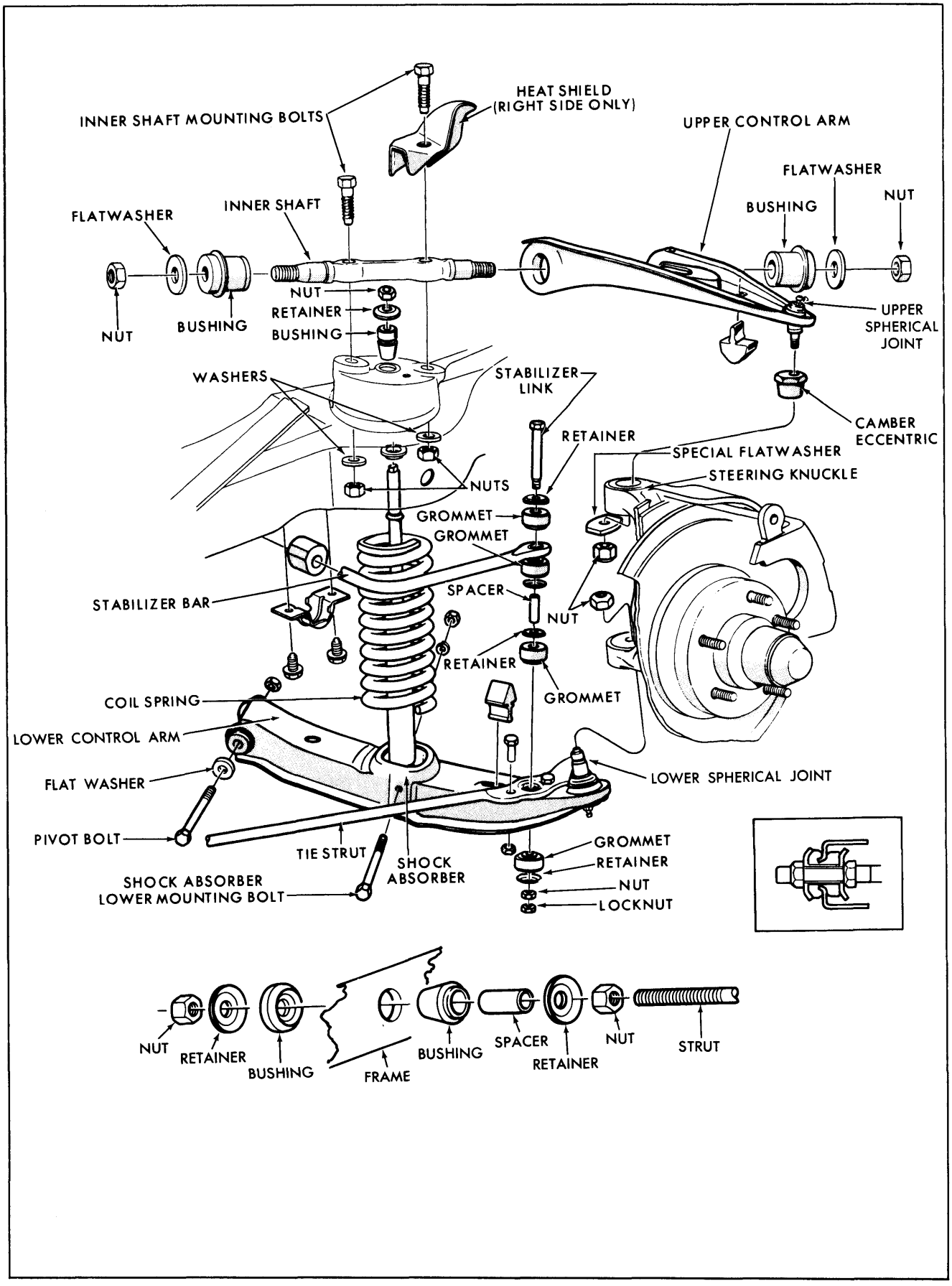


Fig. 3-1 Front Suspension Disassembled

BACK TO INDEX

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FRONT SUSPENSION—EXCEPT ELDORADO
GENERAL DESCRIPTION

All models except the Eldorado use an independent spring type front suspension system, consisting of two upper and two lower control arm assemblies, steel coil springs, shock absorbers, front diagonal tie struts, a stabilizer bar, and two integral steering knuckles, Fig. 3-1. The system is designed so that the geometry of the upper and lower suspension arms produces an anti-dive reaction during braking.

The front suspension used on the Eldorado is described on Page 3-27.

Front Suspension System

a. Spherical Joints

The upper and lower spherical joints are equipped with lubrication fittings. Refer to Section 0 for the lubrication schedule.

The upper spherical joint is pressed into the upper suspension arm and tack-welded to the arm at two points. It connects the upper suspension arm to the steering knuckle through a camber adjustment eccentric. Camber adjustment is made by turning this eccentric to move the steering knuckle in or out at the top. The lower spherical joint, a tension type joint, is pressed into the lower suspension arm. It connects the lower suspension arm to the steering knuckle.

The spherical joints are designed to allow both the up-and-down movement of the wheel due to road irregularities, and the pivoting movement that takes place as the wheels are turned while steering.

b. Compression and Rebound Bumpers

A rubber compression bumper on the lower suspension arm limits upward travel of the suspension system and a rubber rebound bumper on the upper suspension arm limits downward travel. Both bumpers are held in place by means of a pull-through tab.

c. Tie-Struts

Diagonal tie-struts are used on the front suspension system to control the fore and aft movement of the wheels. The struts are bolted to the outer ends of the lower suspension arms just inboard of the spherical joints, and extend forward through the frame strut rod support member. At this point, the struts are threaded and secured by two locknuts. These locknuts also control caster adjustment. The attachment is cushioned by rubber bushings and steel retainers. The tie struts are interchangeable right and left.

d. Suspension Arms

The upper suspension arms pivot at their inner ends on two flanged rubber bushings, one at each end of the one-piece suspension arm shaft, which is bolted to the top surface of the frame spring tower. Upper suspension arm shafts are interchangeable right and left. The lower suspension arms pivot on a single rubber bushing that is bolted to the front suspension frame cross member.

The upper suspension arms and spherical joints tack welded in assembly are not interchangeable left and right. Upper arms and spherical joints prior to assembly are interchangeable between left and right sides. The lower suspension arms are not interchangeable, but their spherical joints are interchangeable.

e. Steering Knuckle

The integral steering knuckle is a combination steering knuckle, brake caliper support, and steering arm.

The steering knuckle is mounted to the tapered spherical joint studs at the outer ends of the upper and lower suspension arms. The splash shield is secured to the steering knuckle with three attaching screws.

The integral steering knuckles are not interchangeable right and left.

f. Stabilizer Bar

A front stabilizer bar is used to provide steering stability and to control body roll. The stabilizer bar is mounted on the frame front side rails forward of the suspension arms and is connected to the lower suspension arms by steel links that are cushioned at each end in rubber bushings. The stabilizer bar extends across the car between its frame mounts.

There are three different diameter stabilizer bars. The same mounting brackets and bushings fit all three bars. On "C"-cars only, the spacer washers are not used between the mounting brackets and frame.

g. Springs and Standard Shock Absorbers

The front wheels are controlled in their up-and-down movement by steel coil springs and direct, double acting, permanently sealed shock absorbers.

The springs are mounted with the lower ends seated on the lower suspension arms and the upper ends seated in towers on the front suspension frame cross member.

(NOTE: To effectively control bumper heights, springs for all models are computer selected according to vehicle weights including all accessories. When replacing springs, be certain to select the proper spring as listed in the Cadillac Parts Manual.)

The standard shock absorbers incorporate a Teflon piston ring for improved piston sealing with temperature variations in the shock. These shock absorbers provide efficient and constant damping control because oil is separated from air in the reservoir, which eliminates aeration of oil and prevents lag. Separation is accomplished by means of a pliacell envelope filled with an inert gas that takes the place of the air pocket.

BACK TO INDEX

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The front shock absorbers are positioned in the center of the coil springs and are attached at the upper ends to the spring seat towers. The lower ends are attached to the lower suspension arms by bolts that go through the arms and the lower shock mount sleeves.

FRONT SUSPENSION DIAGNOSIS CHART

Condition	Cause	Correction
Car pulls to one side.	Uneven tire pressure.	Inflate tires to proper pressure.
	Radial tire lateral force. (conicity)	Rotate tires.
	Front wheel alignment out of specification.	Check and adjust as necessary, Note 2.
	Uneven standing height, left and right.	Perform procedure in Note 1.
	Drag link height incorrect.	Perform procedure in Section 9, Note 5.
	Brakes dragging.	See brake diagnosis.
	Upper or lower suspension arm mounting bolts loose.	Check and correct all fastening torques.
	Wheel bearings adjusted too tight.	Check for binding with front wheels off floor. Adjust and lubricate bearings, Note 18.
	Steering gear valve off center.	Replace valve assembly, Section 9, Note 12c.
	Bent Frame.	Check frame for proper alignment and repair as necessary.
Scuffed tires.	Toe-in incorrect.	Adjust as in Note 2.
	Camber out of specification.	Adjust as in Note 2.
	Tires improperly inflated.	Inflate to proper pressure.
Cupped tires.	Toe-in incorrect.	Adjust as in Note 2.
	Excessive wheel and/or tire runout.	Compensate as explained in Section 10, Diagnosis Charts.
	Wheels or tires out of balance.	Balance wheels and tires.
	Excessive on-center lash in steering gear.	Perform adjustments in Section 9, Note 16.
	Front shock absorber inoperative.	Replace shock absorber, Note 3.

BACK TO INDEX

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FRONT SUSPENSION DIAGNOSIS CHART (Cont'd.)

Condition	Cause	Correction
Cupped Tires (Cont'd.)	Worn upper spherical joint.	Check joint as in Note 7. Replace arm and joint assembly if necessary.
	Worn lower spherical joint.	Check joint as in Note 7. Replace joint if necessary, following procedure in Note 11.
	Excessive (1/4" or more) vertical lash in idler arm frame pivot.	Replace idler arm assembly.
	Wheel bearings worn or incorrectly adjusted.	Adjust or replace bearings as necessary, Note 8.
Front wheel shimmy.	Wheels or tires out of balance.	Balance wheels and tires.
	Wheels or tires out of round.	Compensate for runout as described in Section 10, Diagnosis Charts.
	Rough or cupped tire.	Isolate and replace.
	Steering gear or steering connections incorrectly adjusted or worn.	Check and adjust to specifications.
	Worn spherical joints.	Replace lower joints and/or upper arm assembly.
	Front wheel bearings incorrectly adjusted or worn.	Adjust or replace as required.
	Shock absorbers weak or inoperative.	Check and replace if necessary.
Car wanders	Improper tire inflation.	Inflate to proper pressure.
	Steering gear or connections adjusted too loosely or worn.	Adjust or install new parts as necessary.
	Drag link height or parallelism incorrect.	Check and adjust to specifications.
	Worn spherical joints.	Replace lower joints and/or upper arm assembly.
	Toe-in or caster incorrectly adjusted.	Adjust toe-in and caster.
	Mixed tire brands.	Replace tires so that all are identical brand and type.
	Excessive friction in front suspension.	Check spherical joint seals for damage. If necessary, replace seals and repack joints.
Car waddles (5 to 20 Mph)	Radial tire lateral force variation	Replace offending tire (Refer to tire section)

BACK TO INDEX

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SERVICE INFORMATION

CAUTION: If any mispositioning, incorrect assembly, or failure of components in the area of the brake system pipes, hoses, or cylinders is observed, be sure to check for any brake system damage that may have resulted from such a condition and correct as required. Components that could damage the brake system due to mispositioning, incorrect assembly, or failure include the exhaust system, shock absorbers, springs, suspension control arms, stabilizer bar, power steering pump hoses, and transmission cooler pipes.

When performing front end alignment or other operations that require loosening the camber eccentric in the knuckle by striking the bottom of the stud, exercise caution to prevent the striking tool from slipping and hitting the brake hose or the spherical joint seal.

When removing the camber eccentric or disconnecting the upper control arm ball stud, never use the brake hose to support or suspend the disc or caliper.

Never attempt to straighten a bent part; replace it with a new part.

The following caution applies to certain steps in the assembly procedure of components in this section. The critical fasteners to which this caution applies are identified by the terminology *"Caution: See Page 3-6"*

CAUTION: This fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

1. Checking Front Standing Spring Height

Before checking standing (spring) height, make sure that trunk is empty except for spare tire and jack and that there is a full tank of gasoline, or use compensating weight as shown in Fig. 3-39, as all specifications are based on this curb weight. Normalize position of springs by bouncing bumper up and down. Slowly reduce the force applied until the car seeks its own level.

a. Front Springs

Measure the distance from the top of the lower control arm in front of the rubber bumper to the flat surface of the bottom of the frame. Standing heights should be equal on both sides of car within 3/8 inch. If heights are unequal, it will be necessary to replace the spring on the low side.

See Fig. 3-2 for checking points and specifications for each series.

b. Ride Complaints

In case of hard riding the first items to investigate are tire pressures, standing heights, and shock absorbers. If these are correct, the amount of friction in the front suspension system should be checked.

The procedure for checking excessive friction in the front suspension is as follows:

1. Disconnect front shock absorbers.
2. With aid of a helper, lift up on the front bumper and raise the front end of the car as high as possible. Slowly release the bumper and allow the car to assume normal standing height. Measure distance from the floor to center of bumper. Then push down on bumper, release slowly, and allow car to assume normal standing height; again take measurement at same point on bumper.

If the difference between these two measurements is 1-1/4 inch or more, it indicates excessive friction in the suspension system. Probable causes include damaged seals on the spherical joints permitting dirt and water in the joints, bound up steering linkage, or excessive binding in the stabilizer bar mounting bushings.

2. Front Wheel Alignment

Satisfactory vehicle operation may occur over a wide range of front end (wheel) alignment settings, Fig. 3-3. Nevertheless, should settings vary beyond certain tolerances, readjustment of alignment is advisable. The specifications stated in column 3 of the specifications chart, Fig. 3-4, should be used by owners, dealers, and repairmen as guidelines in vehicle diagnosis either for repairs under the new vehicle warranty or for maintenance service at customer's request. These specifications provide an acceptable all-around operating range in that they prevent abnormal tire wear caused by wheel alignment.

Governmental Periodic Motor Vehicle Inspection programs usually include wheel alignment among items that are inspected. To provide useful information for such inspections, the specifications stated in column 4 of the specification chart are given and these are well within the range of safe vehicle operation.

In the event the actual settings are beyond the specifications set forth in column 3 or 4 (whichever is applicable), or whenever for other reasons the alignment is being reset, Cadillac recommends that the specifications given in columns 1 and 2 of the specification chart be used.

a. Sequence of Operations

Front wheel alignment must be checked whenever the standing height is changed due to a spring replacement, removal and installation of an upper control arm assembly, a lower control arm, tie-strut, or a steering knuckle.

BACK TO INDEX

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VEHICLE STANDING HEIGHTS			
STYLE		FRONT STANDING HEIGHT (INCHES)	REAR STANDING HEIGHT (INCHES)
CALAIS COUPE	STANDARD	3-15/16 TO 4-11/16	5-3/8 TO 6-1/8
	WITH ALC	3-15/16 TO 4-11/16	4-7/8 TO 5-5/8
CALAIS SEDAN	STANDARD	3-15/16 TO 4-11/16	5-3/8 TO 6-1/8
	WITH ALC	3-15/16 TO 4-11/16	4-7/8 TO 5-5/8
COUPE DE VILLE	STANDARD	3-15/16 TO 4-11/16	5-3/8 TO 6-1/8
	WITH ALC	3-15/16 TO 4-11/16	4-7/8 TO 5-5/8
SEDAN DE VILLE	STANDARD	3-15/16 TO 4-11/16	5-3/8 TO 6-1/8
	WITH ALC	3-15/16 TO 4-11/16	4-7/8 TO 5-5/8
FLEETWOOD BROUGHAM	STANDARD	3-7/8 TO 4-5/8	4-7/8 TO 5-5/8
FLEETWOOD 75 SEDAN	STANDARD	4-1/4 TO 4-15/16	5-5/8 TO 6-7/16
	W/RADIAL TIRES	4-5/8 TO 5-5/16	6-1/16 TO 6-7/8
FLEETWOOD 75 LIMO	STANDARD	4-1/4 TO 4-15/16	5-5/8 TO 6-7/16
	W/RADIAL TIRES	4-5/8 TO 5-5/16	6-1/16 TO 6-7/8
ELDORADO COUPE	STANDARD	8-3/16 TO 8-7/16	4-13/16 TO 5-9/16
ELDORADO CONVERTIBLE	STANDARD	8-3/16 TO 8-7/16	4-13/16 TO 5-9/16

CHECKING POINTS

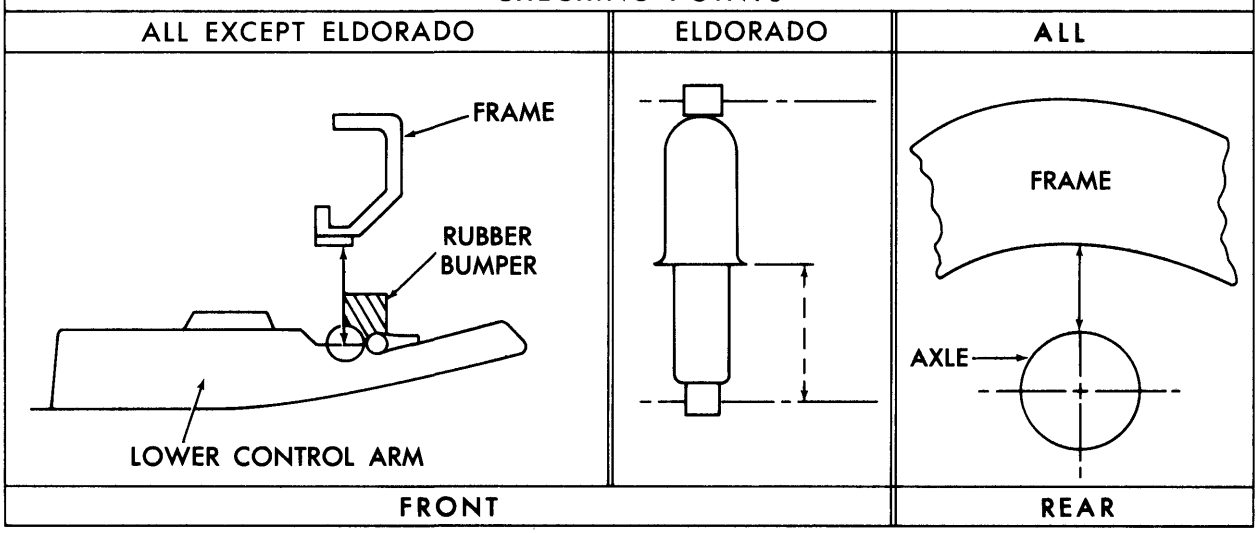


Fig. 3-2 Checking Standing Heights

BACK TO INDEX

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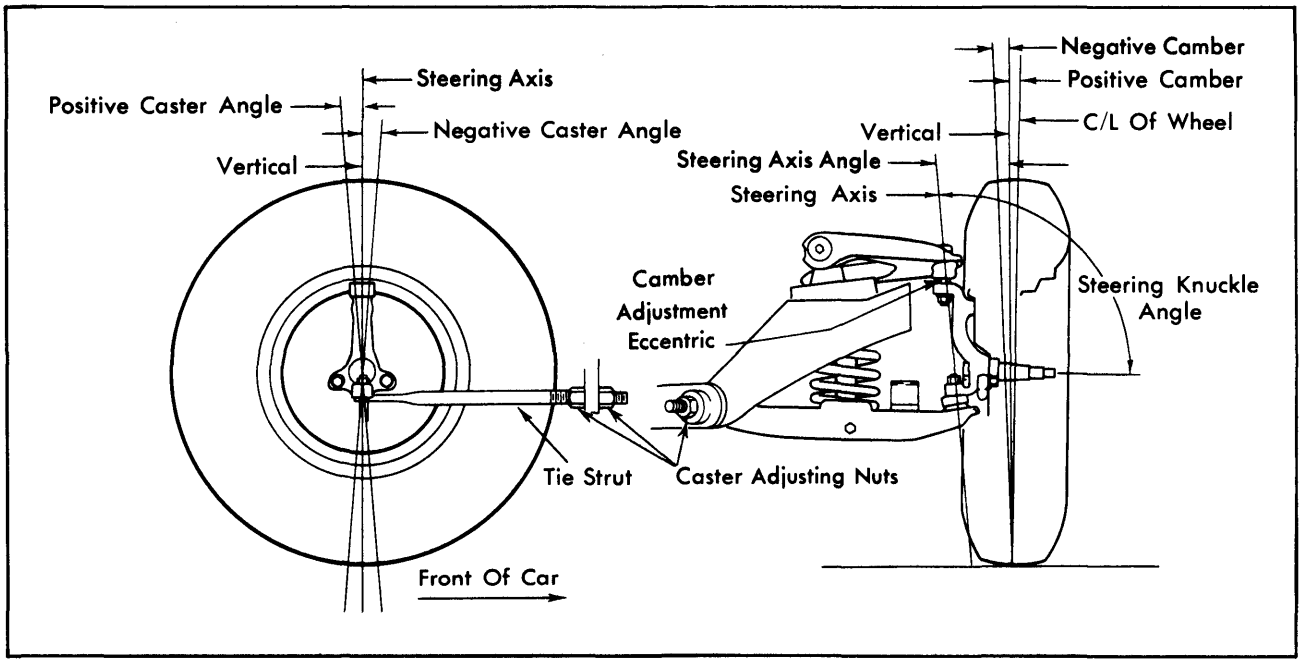


Fig. 3-3 Elements of Front Wheel Alignment

Wheel alignment equipment manufacturers provide detailed instructions for checking wheel alignment with their alignment equipment. These instruction should be carefully followed.

In addition to the manufacturer's instructions, be sure to observe the following recommendations:

1. Check straight ahead position of steering wheel by driving vehicle a short distance. Place a piece of tape on steering wheel at straight ahead position of wheel for future reference, so that any correction needed can be made during the toe-in adjustment.
2. Car must be on a level surface, gas tank full or a compensating weight added as shown in Fig. 3-39, front seat all the way to the rear, and front and rear tires inflated to the proper pressures. Refer to Tire Pressure Chart, Fig. 10-1, Section 10. Both doors must be closed and no passengers or additional weight should be in car or trunk.
3. Check front standing height. Refer to Note 1.
4. Check front wheel alignment and adjust as required.
5. After removing the vehicle from the alignment machine, check the straight ahead position of the steering wheel to determine if it is properly centered. If further correction is required, repeat the toe-in portion of the wheel alignment procedure so that the necessary changes can be made.

b. Caster

Caster adjustment is obtained by shortening or lengthening the tie-struts between the lower suspension arms and frame strut rod support member to tilt the vertical steering axis of the knuckle, Fig. 3-3. Tilting toward the front of the vehicle results in negative caster – toward the rear, positive caster.

Before adjusting caster, loosen tie-struts at lower suspension arms. This will allow tie-strut to center itself and prevent damage to bushings and premature wear at frame strut rod support member.

To provide more negative caster, lengthen tie-struts by loosening front locknuts and tightening rear locknuts. One turn of locknuts results in approximately 1/2° change in caster. Use J-24515 caster adjusting wrench to loosen and tighten rear caster adjusting nut.

To provide more positive caster, shorten tie-struts by loosening rear locknuts and tightening front locknuts.

After proper caster adjustment has been made, tighten tie-strut mounting bolt nuts at lower arms to 55 foot-pounds, and front locknuts to 50 foot-pounds, Fig. 3-5.

CAUTION: See Page 3-6.

Recheck to make sure adjustment is correct after locknuts have been tightened.

c. Camber

Camber, Fig. 3-3, is adjusted at the camber eccentric located in the upper portion of the steering knuckle, Fig. 3-6. The upper spherical joint stud fits through the camber eccentric and the knuckle. Turning camber eccentric moves the steering knuckle in or out at the top.

To adjust camber, loosen locknut on spherical joint stud one turn and strike steering knuckle in area of spherical joint stud to free camber eccentric in steering knuckle, Fig. 3-7.

CAUTION: Use extreme care to prevent the striking tool from slipping and damaging either the brake hose or the spherical joint seal.

Using Camber Adjustment Wrench, J-23415, Fig. 3-8, turn camber eccentric until desired camber is obtained.

Final position of joint stud should be in rear portion of camber eccentric in order to keep steering arm angle

BACK TO INDEX

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C-CAR WHEEL ALIGNMENT SPECIFICATIONS*

	SPECIFICATIONS FOR RESETTING ALIGNMENT ①	②	③ TOLERANCE FOR DIAGNOSIS FOR WARRANTY REPAIRS OR CUSTOMER PAID SERVICE	④ TOLERANCE FOR PERIODIC MOTOR VEHICLE INSPECTION
Tire Used	LR78–15/B	LR78–15/D		
Series	All Exc 75's	Fleetwood 75's		
Camber	LH $0^{o} \pm 3/8^{o}$ RH $-1/4^{o} \pm 3/8^{o}$	LH $0^{o} \pm 3/8^{o}$ RH $-1/4^{o} \pm 3/8^{o}$	$\pm 3/4^{o}$	$\pm 1\ 1/2^{o}$
Cross Camber (LH Minus RH)	$1/4^{0} \pm 1/2^{o}$	$1/4^{o} \pm 1/2^{o}$	$\pm 1^{o}$**	–
Caster	$0^{o} \pm 1/2^{o}$	$-1^{o} \pm 1/2^{o}$	$\pm 1^{o}$	$\pm 2^{o}$
Cross Caster (LH Minus RH)	$0^{o} \pm 1/2^{o}$	$0^{o} \pm 1/2^{o}$	$\pm 1^{o}$**	–
Toe-In	1/8" ±1/16"	1/8" ±1/16"	±1/8"	±3/8"

*Vehicle must have full lubricant, coolant and fuel levels with no passengers or luggage.

**Cross camber and cross caster not to exceed 1^{o} maximum per vehicle.

Fig. 3-4 C-Car Wheel Alignment Specifications

BACK TO INDEX

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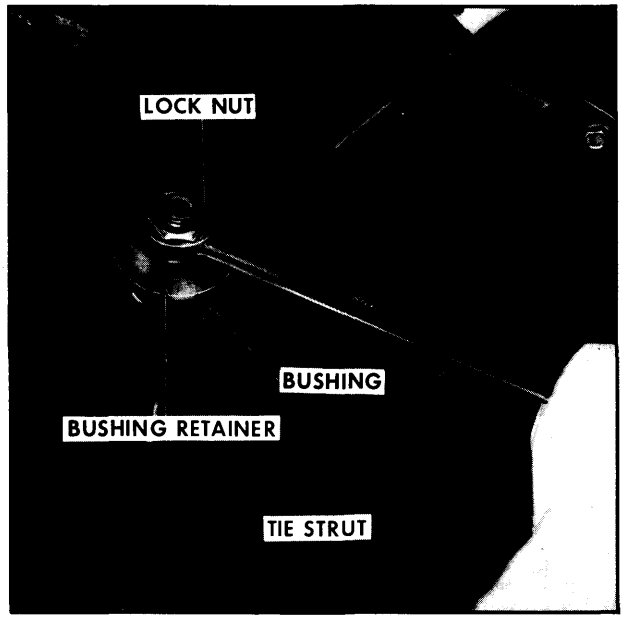


Fig. 3-5 Adjusting Caster

correct. Tighten locknut on spherical joint stud to 60 foot-pounds.

CAUTION: See Page 3-6.

d. Toe-In

Before checking toe-in Fig. 3-4, make certain that drag link height is correct. See Section 9, Note 5, for drag link height.

The readings should be taken only when the front wheels are in a straight ahead position so that the steering gear is on its high spot.

Toe-in is adjusted by turning the tie rod adjuster tubes at outer ends of each tie rod after loosening clamp bolts.



Fig. 3-6 Camber Adjusting Eccentric



Fig. 3-7 Loosening Camber Eccentric

CAUTION: To prevent damage to the tubes, do not use a pipe wrench or heavy tool to free tie rod adjuster tubes if they are seized, rusted, or corroded. If necessary, use penetrating oil or pry tie rod adjuster tubes open with a flat bladed tool. Replace tie rod adjuster tubes, or tie rod outer pivots if damaged. If torque required to remove nuts from bolt after breaking nut loose exceeds 84 inch-pounds, discard nut and bolt.

The tie rod adjuster tubes should be lubricated with chassis lubricant if disassembled from tie rods for any reason. When turning adjuster tubes, be



Fig. 3-8 Adjusting Camber

BACK TO INDEX

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careful not to turn tie rod ends so that they bottom out, as seals could become pinched between stud and socket and become damaged. If this happens, the entire pivot must be replaced.

Be sure to turn both adjuster tubes an equal amount when adjusting toe-in so that relation of steering gear high spot to straight ahead position of front wheels will not be changed.

When adjustment has been completed according to recommended specifications, tighten nuts on clamp bolts to 22 foot-pounds.

Both the tie rod ends and joint studs should be in a centralized position before tightening clamps. Check relationship between jaws of clamp and slot in adjuster tube. Do not allow corner of one to catch on a corner of the other, Fig. 3-9.

Each tie rod should be checked after adjustment by grasping the center of the tie rod and rotating the rod assembly.

The movement should be through an angle of 20 to 30 degrees total. If not, it is an indication that the pivot studs are not properly positioned. If tie rods are not properly positioned, a binding condition may occur, resulting in poor return of wheels to straight ahead position. Also check steering linkage joints for looseness. Replace inner or outer tie rod pivot if loose.

3. Front Shock Absorbers

a. Removal

1. Raise hood and remove shock absorber upper retaining nut and retainer at frame spring tower. The shock absorber upper stem is square at the top so that it may be held by a wrench to prevent stem from turning when removing nut.
2. Remove bolt, nut, and lockwasher holding lower end of shock absorber to lower suspension arm.

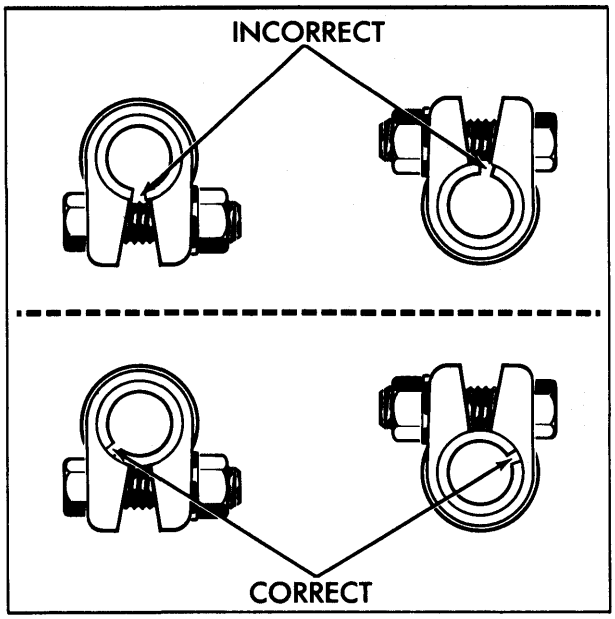


Fig. 3-9 Tie Rod Clamp Position

3. Remove shock absorber through bottom of lower arm.

b. Installation

1. If new grommet is required, dip grommet in a soapy water solution and force grommet through frame hole with a twisting motion.

CAUTION: Do not use silicone lubricant. The soapy water will dry and allow the grommet to seal. Silicone will not.

2. Install retainer on shock absorber upper stem, and fully extend shock absorber rod.
3. Insert shock absorber assembly up into coil spring and guide stem through grommet. Then place lower end in position on lower suspension arm, and install bolt, lockwasher, and nut. Tighten bolt to 55 foot-pounds.
4. Install retainer and nut on shock absorber upper stem, and tighten nut to 180 inch-pounds, while holding stem from turning with wrench.

4. Checking Front Shock Absorbers

1. Check all tire pressures.
2. Check shock absorber mounting torques.
3. If possible, road test car to determine the exact nature of the problem.
4. Quickly alternate pushing down and lifting left front corner of bumper. Repeat process for right front corner. The feeling of resistance should be equal between right and left. If so, it is unlikely that either shock requires replacement. If noticeable variation is felt, proceed to Step 6.
5. Visually inspect shock absorbers. If oil is detected, check for leaks in power steering system, transmission cooler lines, etc.

(NOTE: A slight trace of shock fluid is not cause for replacement as the seal permits some seepage from fluid reserve for piston rod lubrication.)

6. Raise car and remove one shock absorber.
7. Clamp shock absorber upside down in vise.

(NOTE: Cadillac shock absorbers can be turned upside down because all internal vapor, inert gas instead of air, is contained in a pliacell envelope which prevents aeration of oil and prevents lag. "If a lag is noticed when stroked, it means the pliacell envelope has been ruptured and the shock should be replaced".)

8. Pump shock by hand at various rates of speed and observe resistance. Resistance should be smooth and constant.

(NOTE: Rebound resistance is approximately twice as strong as that of compression.)

9. Compare resistance felt with that of a unit known to be good. The following conditions are abnormal and require replacement of shock absorber:

a. A skip or lag at reversal near mid-stroke.
b. A seize (except at either extreme of travel)

BACK TO INDEX

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c. A grunt or squeal after completion of one full stroke in each direction.

d. A clicking noise at fast reversal.

e. Fluid leakage.

A skip at full extension with shock absorber inverted, or a faint hiss ("orifice swish") are normal conditions and do not indicate necessity of shock absorber replacement.

5. Stabilizer Bar

a. Removal

1. Remove nuts, retainer, and grommet from bottom of each stabilizer link, Fig. 3-10.

2. Remove bolts from mounting brackets that hold stabilizer to frame and remove brackets.

3. Remove rubber bushings from stabilizer bar, and remove grommets, retainers, spacers, and links from ends of stabilizer bar.

4. Turn wheels to full stop and work stabilizer bar from car.

b. Installation

1. Position stabilizer bar under front frame side rails and slide rubber bushings in place.

(NOTE: Stabilizer bar grommets and retainers are larger than those used on shock absorbers. Replacement parts must be of this larger design.)

2. Install mounting brackets over rubber bushings and secure with bolts, Fig. 3-10. Tighten bolts to 35 foot-pounds.

3. Install grommets, retainers, links, and spacers on ends of stabilizer bar, making certain that retainers and grommets are arranged exactly as shown in Fig. 3-10.

4. Install grommet, retainer and nut. Install locknut on bottom of each link. Tighten nuts to 150 inch-pounds.

6. Tie-Strut and Bushings

a. Removal

1. Raise car.

2. Disconnect stabilizer link from lower arm on side from which tie-strut is to be removed.

3. Remove locknut, bushing retainer, and bushing from forward end of tie-strut, Fig. 3-11.

(NOTE: If replacing only bushings, do not disturb rear locknut on tie-strut, otherwise it will be necessary to readjust caster and camber.

4. Remove two bolts and nuts securing tie-strut to lower suspension arm and remove strut.

5. Remove tie strut from car.

6. Remove rear bushing, spacer, and retainer from tie-strut.

7. Remove rear locknut from tie-strut if necessary.

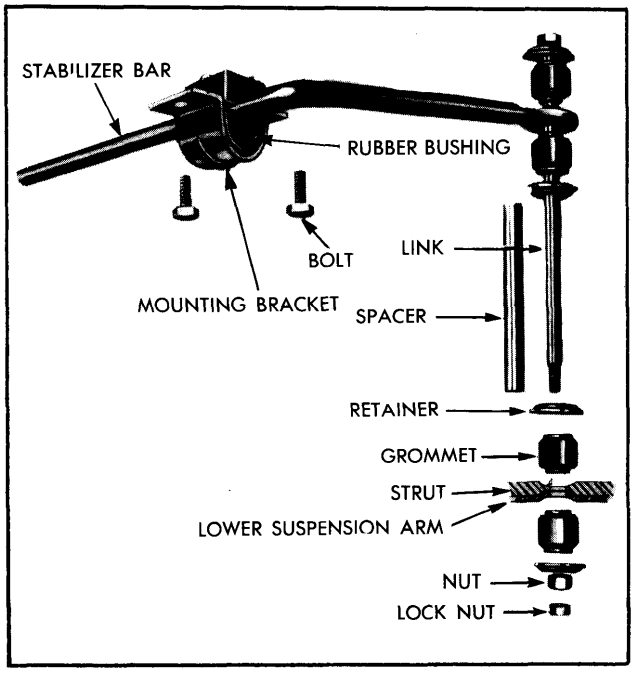


Fig. 3-10 Front Stabilizer Linkage

b. Installation

1. If rear locknut was previously removed, install a new locknut (3/4 inch thick) on threaded end of tie-strut, and run nut approximately 3/4 inch from end of thread. See Fig. 3-1 for correct arrangement of parts.

2. Install rear bushing retainer on tie-strut with concave side against nut.

3. Insert metal spacer part way through conical shaped bushing from small end, and install on tie-strut with small end toward front of car.

4. With tie-strut held in a horizontal position, install threaded end through frame strut rod support member.

5. Position opposite end of tie-strut on lower suspension arm with pointed end pointing inward, and install two attaching bolts and nuts loosely.

6. Install front bushing on end of tie-strut, concave side toward frame, and slide bushing against strut rod support member.

7. Install front bushing retainer on tie-strut with concave side against bushing, Fig. 3-11.

8. Start new locknut (5/8 inch thick) on threaded end of tie-strut.

9. Connect stabilizer link to lower suspension arm. Make certain that grommets, retainers, nuts, and locknuts are installed properly.

10. Lower car and, with car weight on all four wheels, position front bushing on metal spacer and tighten locknut on front end of tie-strut to 50 foot-pounds.

CAUTION: See Page 3-6.

11. Tighten tie-strut to lower arm attaching nuts to 55 foot-pounds.

CAUTION: See Page 3-6.

12. If rear locknut was disturbed during tie-strut removal or installation, adjust caster and camber as described in Notes 2b and 2c.

BACK TO INDEX

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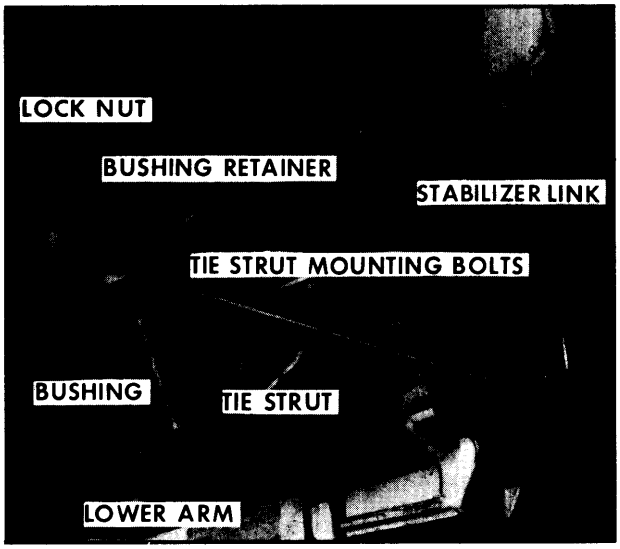


Fig. 3-11 Front Suspension Tie Strut

7. Front Suspension Spherical Joint Checking Procedures

a. Upper Spherical Joints

1. Raise car, place jack stands under lower control arm, and remove wheel and tire assembly. Scribe or punch an alignment mark between steering knuckle and camber eccentric to facilitate reinstallation.
2. Back off upper spherical joint stud locknut approximately two turns. Do not remove locknut. This will prevent hub and rotor from collapsing outward when joint stud is broken free from knuckle.
3. Using a hammer, strike steering knuckle in area of upper spherical joint stud to separate joint and knuckle, Fig. 3-7, then remove locknut and flat washer from stud.

CAUTION: Use extreme care to prevent hammer from slipping and damaging either the brake hose or spherical joint seal.

(NOTE: On some cars, camber eccentric may come out with stud. This is a normal condition.)

4. Lift upper arm to remove spherical joint stud from knuckle.
5. Using regular spherical joint stud nut and a second nut as a locknut, turn joint in its socket with an inch-pound torque wrench. Reading should fall between 24 and 48 inch-pounds. If joint is too tight or too loose, replace joint and upper arm as an assembly.
6. Remove both nuts from stud.
7. Install joint stud in knuckle and install special flat washer and an ordinary nut on stud. Tighten nut to seat joint stud in knuckle.

(NOTE: If camber eccentric separated from knuckle in Step 3, use alignment marks for proper orientation.)

8. Remove nut and install locknut, tightening to 60 foot-pounds.

CAUTION: See Page 3-6.

9. Install wheel and tire assembly, tightening wheel mounting nuts to 130 foot-pounds.

CAUTION: See Page 3-6.

10. Check camber and caster and adjust if necessary, as described in Notes 2b and 2c.

b. Lower Spherical Joints (Fig. 3-12)

The lower spherical joint on C-cars is inspected for wear visually. Wear is indicated by protrusion of a nipple into which the service plug is threaded. This round nipple protrudes .050" beyond the surface of the spherical joint lower cover on a new, unworn joint. Normal wear will result in the surface of this nipple retreating very slowly inward.

To inspect for wear, clean all road deposits from the spherical joint lower cover and service plug. Carefully observe the position of the nipple relative to the lower cover. If the nipple is flush with, or inside the cover surface, replace the spherical joint.

(NOTE: Spherical joint service set, J-9519-02 available at dual dealers may be used to install the front lower C-car spherical joints.)

8. Front Upper Suspension Arm Spherical Joint Seal Replacement (On Car)

1. Raise front end of car and place jack stands under lower suspension arms.
2. Remove wheel and tire assembly.
3. Loosen upper spherical joint locknut.
4. Scribe a mark on camber eccentric and steering knuckle to facilitate alignment at time of installation.
5. Using a hammer, strike steering knuckle in area of upper spherical joint stud until joint is free from steering knuckle, then remove nut and special flat washer from stud, Fig. 3-7.

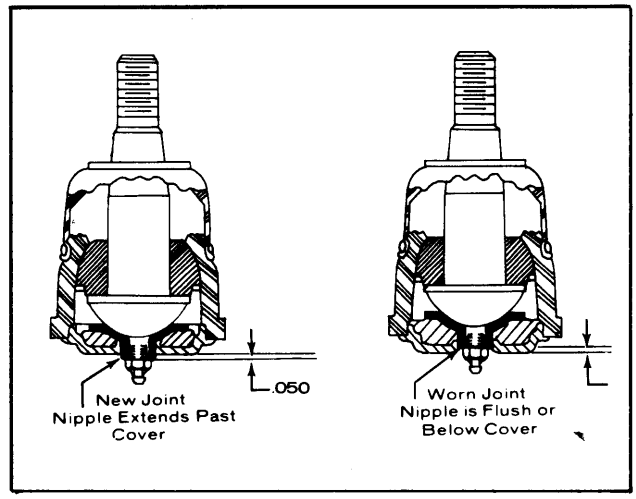


Fig. 3-12 Checking Lower Spherical Joint (C-Car)

BACK TO INDEX

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CAUTION: Use extreme care to prevent hammer from slipping and damaging the brake hose.

6. Raise up on upper arm and remove spherical joint from steering knuckle.

7. Remove camber eccentric from joint stud, using Puller, J-24319, Fig. 3-13.

(NOTE: In cases where camber eccentric is seized or "frozen" to joint stud, remove upper suspension arm assembly, and remove camber eccentric as a bench operation.)

8. Wipe outer seal surface clean to prevent any dirt from lodging in joint pivot when seal is removed.

9. Pry garter spring from seal. Remove and discard seal and spring.

10. Clean joint pivot and stud thoroughly, removing all old grease and any dirt accumulation.

11. Inspect ball pivot for loosening or binding. Note 7. Joint should turn in its socket at 24 to 48 inch-pounds. If spherical joint is damaged or worn, replace joint and arm as an assembly.

12. Unscrew lubrication fitting from spherical joint cover.

13. Install new seal on spherical joint. Proceed as follows:

a. Apply a small amount of lubricant, Part No. 1050411 or equivalent, around hole in seal. Wipe groove in joint housing clean and install seal on joint stud. Make certain the large groove diameter of seal engages in recess (circular groove) around joint housing.

b. Allow air to enter seal by momentarily prying large lip of seal away from joint housing with a small screwdriver.

c. Grasp small end of seal and extend toward threaded end of stud.

d. Install new garter spring on the smaller flanged surface of Garter Spring Installer, J-9148, and lubricate inside diameter of installer with suspension lubricant.

e. Install spring on seal using Garter Spring Installer, J-9148, Fig. 3-14. Make certain that spring secures lip of seal in recess all around joint housing.

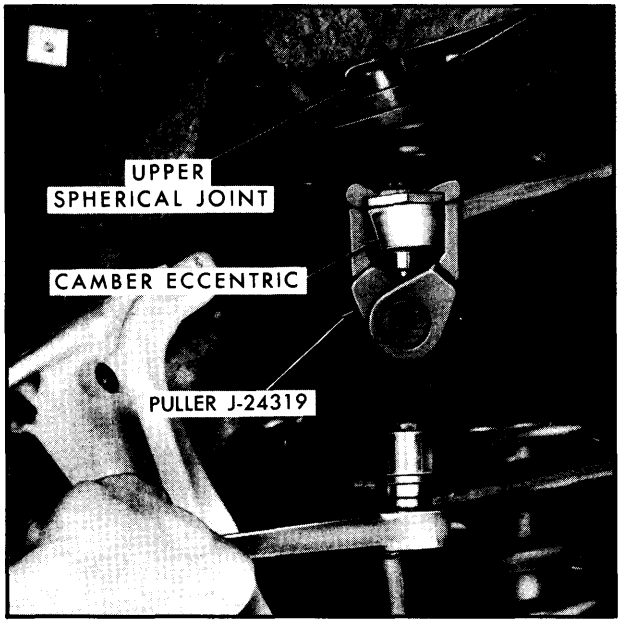


Fig. 3-13 Removing Camber Eccentric

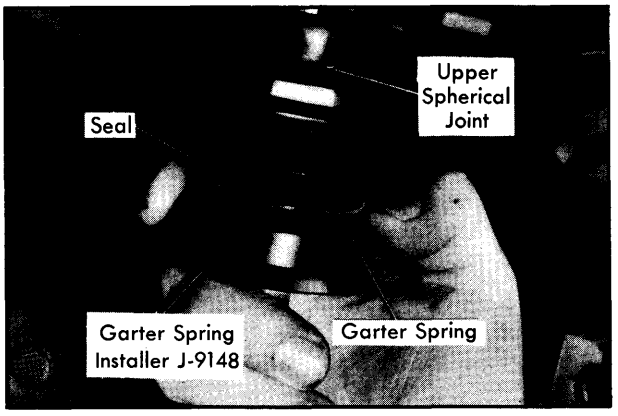


Fig. 3-14 Installing Garter Spring

(NOTE: If spring should separate where it is joined together, it is not an indication that the spring is broken. Join spring ends together and lock by twisting male end counterclockwise approximately 2-3 turns. Ends will thread into each other upon releasing.)

14. Install lubrication fitting and apply lubricant, Part No. 1050411 or equivalent, until approximately two teaspoons of lubricant escapes under the seal at the screwdriver, Fig. 3-15. Any water trapped in the joint should be forced out by the fresh lubricant.

CAUTION: Make certain that proper type lubricant is used when repacking suspension joints as use of other lubricant may not provide sufficient lubrication.

15. Apply a light coating of grease on outside taper of camber eccentric and install camber eccentric on joint stud.

16. Thoroughly clean inside of steering knuckle and install joint stud and camber eccentric in steering knuck-

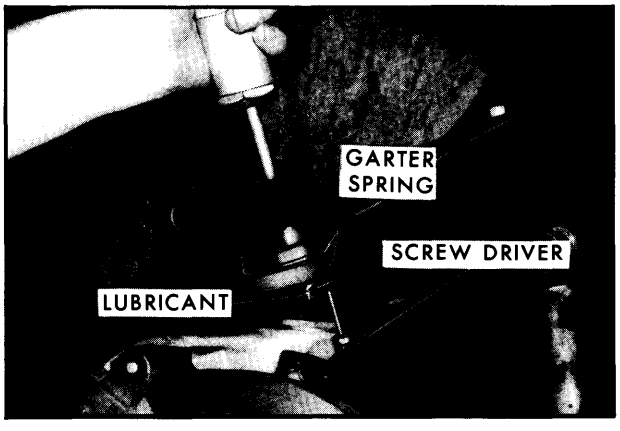


Fig. 3-15 Repacking Upper Spherical Joint

BACK TO INDEX

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le, remembering to align scribe marks on eccentric and knuckle.

17. Install special flat washer and standard 1/2"-20 nut on joint stud and tighten nut until camber eccentric locks in knuckle; then remove standard nut, holding flat washer in place, and install locknut, tightening to 60 foot-pounds.

CAUTION: See Page 3-6.

18. Install wheel and tire assembly, remove jack stands, and lower car.

19. Check camber and caster and adjust if necessary, following Notes 2b and 2c.

9. Repacking Front Lower Suspension Arm Spherical Joint Seal

1. Raise car.
2. Clean off all road deposits from affected lower spherical joint seal.
3. Apply lubricant, Part No. 105 0411 or equivalent, until grease is forced out between upper end of seal and knuckle, Fig. 3-16. Any water trapped in the joint should be forced out by the fresh lubricant.

CAUTION: Make certain that proper type lubricant is used when repacking suspension joints as use of other lubricant may not provide satisfactory lubrication.

4. Inspect seal for cuts, chafes, or pin holes. Escape of lubricant from any place other than top of seal indicates a damaged seal that should be replaced.
5. Repeat steps 2 through 4 on opposite side of car.
6. Lower car.

10. Front Lower Suspension Arm Spherical Joint Seal Replacement (On Car)

1. Raise car and place jack stands under lower suspension arms approximately 2 inches inboard of spherical joints.

CAUTION: Jack stands must be used to prevent lower arm from swinging down when locknut is removed from joint stud.

2. Remove wheel and tire assembly.
3. Remove locknut from lower spherical joint stud and install a standard nut on joint stud, running nut to within two threads of steering knuckle support. This nut will prevent lower arm from dropping down when joint stud is broken free of steering knuckle.
4. Raise front of car slightly off jack stands with hydraulic jack.
5. Strike steering knuckle with a heavy hammer in area of spherical joint stud to break stud loose.

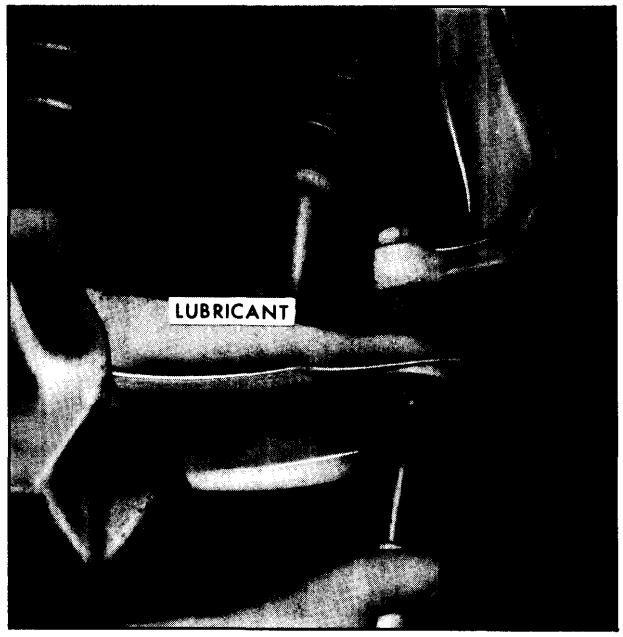


Fig. 3-16 Repacking Lower Spherical Joint

CAUTION: Use extreme care to prevent hammer from slipping and damaging the brake hose.

6. Lower car on jack stands, being certain that rebound bumper on upper arm clears frame, and remove standard nut from joint stud.
7. Lift hub and caliper and remove steering knuckle from lower joint stud.
8. Wipe outer seal surface clean to prevent any dirt from lodging in joint pivot when seal is removed.
9. Pry copper band off bottom of seal. Remove and discard seal and band.
10 Clean joint pivot and stud thoroughly, removing all old grease and any dirt accumulation.
11. Unscrew lubrication fitting from spherical joint.
12. Install a new seal on spherical joint using Seal Band Installer, J-22610, Fig. 3-17, to position band on seal as shown in Fig. 3-18.

CAUTION: Spherical joint housing at point of seal contact must be completely clean to insure a good seal when band is installed.

13. Install lubrication fitting and apply lubricant, Part No. 1050411 or equivalent, until approximately two teaspoons of lubricant escapes from the joint, Fig. 3-16.
14. Guide spherical joint stud into steering knuckle support.
15. Install standard nut and an ordinary flat washer on joint stud and tighten nut until joint stud seats in steering knuckle support.
16. Remove standard nut and washer and install locknut on joint stud, tightening to 85 foot-pounds.

CAUTION: See Page 3-6.

(NOTE: A large quantity of grease will purge from

BACK TO INDEX

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Fig. 3-17 Installing Spherical Joint Band

upper end of joint because seal volume is reduced when installed in steering knuckle. Remove excess grease.)

17. Install wheel and tire assembly, tightening wheel mounting nuts to 130 foot-pounds.

CAUTION: See Page 3-6.

18. Replace wheel disc, remove jack stands, and lower car.

11. Front Lower Suspension Arm Spherical Joint

a. Removal

1. Remove lower suspension arm and coil spring as described in Note 15a.

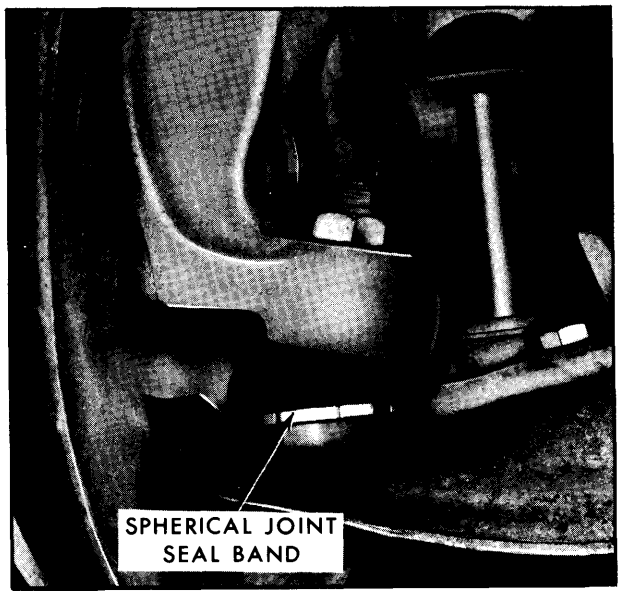


Fig. 3-18 Spherical Joint Band Position

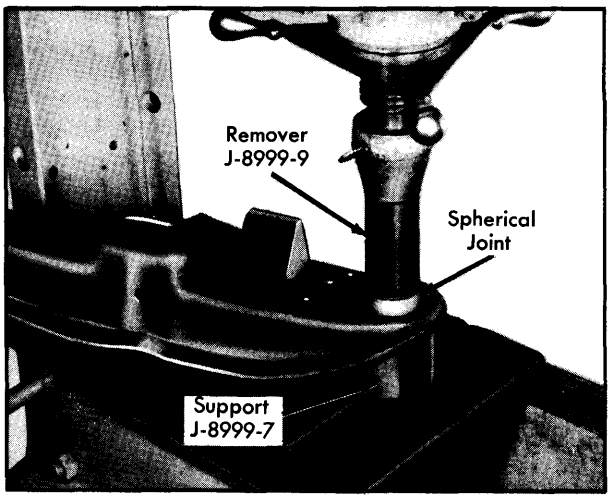


Fig. 3-19 Removing Lower Spherical Joint

2. Remove band and seal from spherical joint.
3. Using an arbor press, position Support, J-8999-7, on press anvil and place lower arm on Support with spherical joint cover resting in Support.
4. Position Spherical Joint Remover, J-8999-9, over joint stud until it seats on joint housing, Fig. 3-19, and press spherical joint out of arm.

b. Installation

1. Using an arbor press, position Support, J-8999-7, on press anvil and place lower arm on support, bottom side up, so that spherical joint mounting hole is encompassed by support.
2. Insert new spherical joint in arm, stud end first, aligning joint housing with mounting hole.
3. Position Spherical Joint Installer, J-8999-5, on flanged portion of joint housing, Fig. 3-20, and press spherical joint into arm until joint flange bottoms on mounting hole flange.

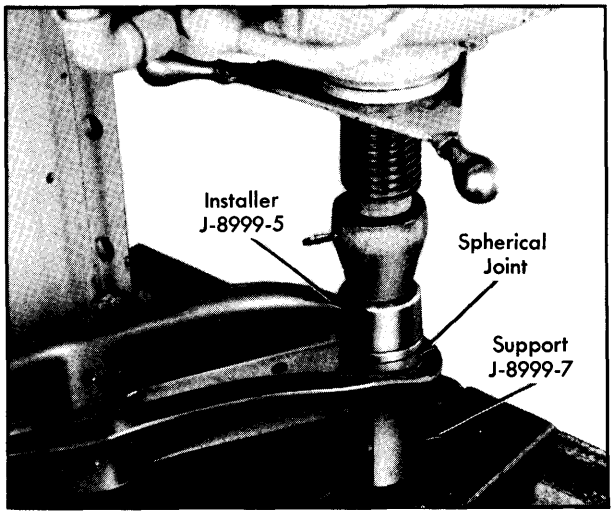


Fig. 3-20 Installing Lower Spherical Joint

BACK TO INDEX

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4. Install lower suspension arm and coil spring as described in Note 15b.

12. Front Upper Suspension Arm

a Removal

1. Raise front of car and remove wheel and tire assembly.
2. Remove locknut from upper spherical joint stud and install a standard nut on end of joint stud to within 2 threads of tight to knuckle.
3. Using a hammer, strike steering knuckle in area of upper spherical joint stud until joint is free from steering knuckle. Support on jack stands located under lower suspension arms as close to spherical joints as possible. Then remove nut from stud, Fig. *Page 3-6.*

CAUTION: Use extreme care to prevent hammer from slipping and damaging either the brake hose or the spherical joint seal.

4. Remove nuts, washers, and shaft mounting bolts at frame tower, Fig. 3-21. Remove upper suspension arm and shaft assembly. If right upper control arm is being removed, remove rear bushing heat shield.
5. Remove nut and flat washer from each end of shaft.
6. Camber eccentric may be removed from spherical joint stud if necessary, by using Puller, J-24319.

CAUTION: Do not attempt to remove spherical joint from upper suspension arm. Since it is welded to arm, any rewelding could damage joint seal or weaken arm. The upper arm and spherical joint are serviced as an assembly.

b. Installation

1. Position upper arm assembly on frame tower. If right upper control arm is being installed, position heat shield over rear bushing and install mounting bolts, washers, and locknuts, Fig. 3-21. Tighten bolts to 85 foot-pounds.

CAUTION: See Page 3-6.

2. Install camber eccentric on joint stud if previously removed.
3. Guide joint stud and camber eccentric into upper end of knuckle and install standard nut and special flat washer on end of joint stud.
4. Tighten nut until camber eccentric seats in knuckle; then remove standard nut and, holding flat washer in place, install locknut. Tighten to 60 foot-pounds.

CAUTION: See Page 3-6.

5. Install wheel, remove jack stands, and lower car. Then tighten wheel mounting nuts to 130 foot-pounds.

CAUTION: See Page 3-6.

6. Install flat washer and shaft attaching nut on each end of shaft. Tighten nuts to 85 foot-pounds.

CAUTION: See Page 3-6.

7. Check wheel alignment and adjust if necessary.

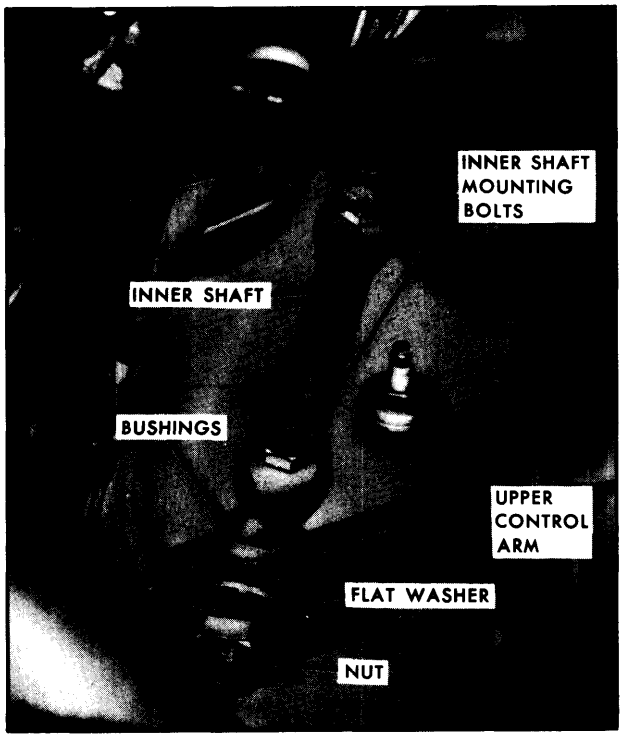


Fig. 3-21 Upper Control Arm Shaft

13. Front Upper Suspension Arm Shaft and Bushings

It will be necessary to make two spacers from cold rolled steel or similar material to facilitate removal of bushings from shaft. Dimensions of the spacers are shown in Fig. 3-22. Also provide two 1/2 inch x 2 inch bolts with nuts to hold spacers in position around shaft.

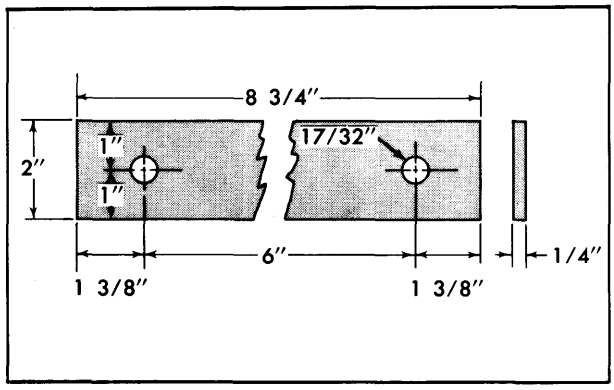


Fig. 3-22 Bushing Remover Spacer

BACK TO INDEX

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a. Removal

1. Remove upper suspension arm assembly, following procedure of Note 12a.
2. Install spacers on shaft between arm ends. Secure spacers to shaft with bolts and nuts, Fig. 3-23.
3. Apply a liberal amount of penetrating oil between bushing sleeve and arm.
4. Position Support, J-8999-2, on anvil of arbor press and place one end of arm on support with outer end of bushing resting in support.

(NOTE: It will be necessary to drill a 1-1/4" hole in center of base of Support, J-8999-2, so that shaft does not bottom before bushing is removed. Position anvil of press so that slot in anvil aligns with hole in Support, J-8999-2.)

5. Insert Spacer, J-8999-1, to prevent control arm from bending when bushings are pressed out.
6. Press shaft downward until spacer plates touch extruded flanges of control arm, Fig. 3-23.
7. Remove arm assembly from arbor press, insert on opposite end, and repeat step 6.
8. Remove arm assembly from arbor press. If necessary, tap end of bushing with hammer to complete its removal.
9. Remove Spacer, J-8999-1, from assembly. Remove spacer bolts, nuts, and plates from shaft, and remove shaft.

b. Installation

1. Position one Bushing Installer, J-8999-25, on arbor press anvil.

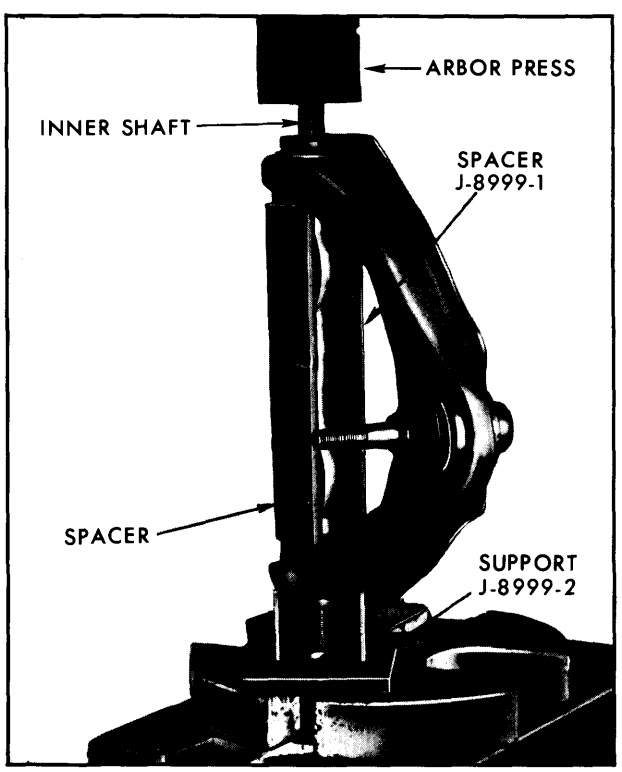


Fig. 3-23 Removing Shaft Bushings

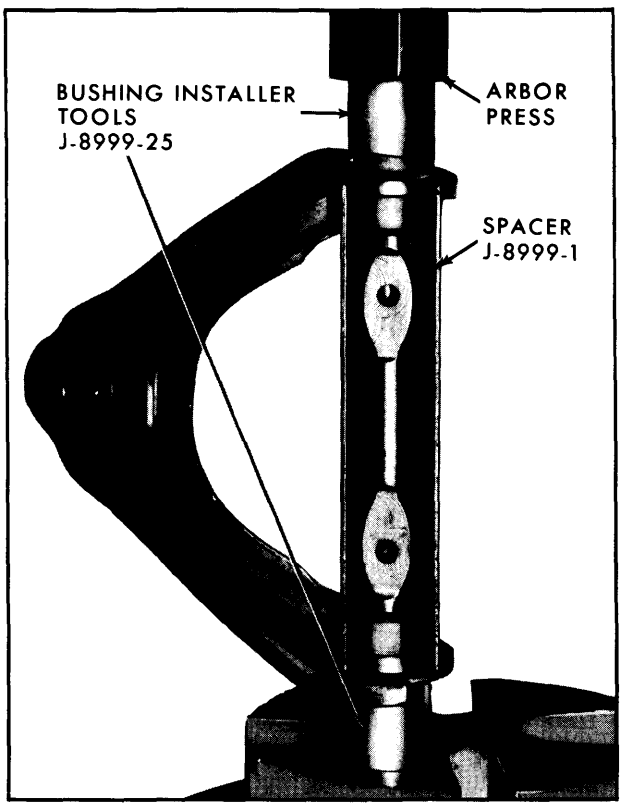


Fig. 3-24 Installing Shaft and Bushings

2. Insert inner shaft in control arm and place bushing over end of shaft and into hole in control arm.
3. Place arm and bushing on bushing installer with outer end of bushing seated in installer, Fig. 3-24.
4. Rotate inner shaft until a 14° angle is achieved between shaft and control arm as shown in Fig. 3-25. This angle can be found by inverting the arm and placing a 2 1/2 inch block of wood under the edge of the arm at the spherical joint end. Keep the lower flat of the shaft on the same surface as the wood block.

(NOTE: This angle is important in that it prevents bushing strain after installation and lengthens bushing life.)

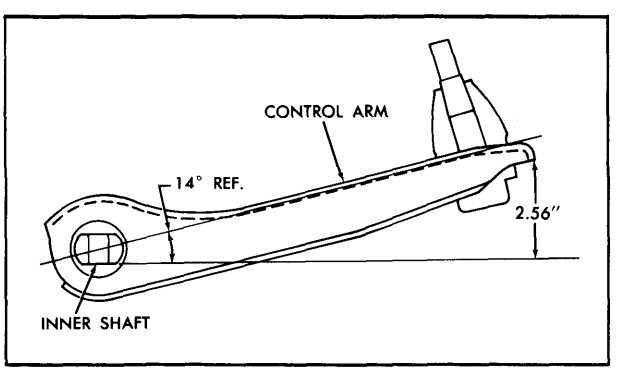


Fig. 3-25 Control Arm Alignment

BACK TO INDEX

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5. Position bushing on opposite end of shaft, and place the other Bushing Installer, J-8999-25, on top of bushing. Hold assembly in place by exerting slight pressure on arbor press, Fig. 3-24.

6. Check alignment of bushings, arm ends, and shaft.

7. Install Spacer, J-8999-1, around shaft between arm ends to prevent arms from collapsing when bushings are installed.

8. Using arbor press, press bushings onto shaft until both bushing flanges bottom on arms.

(NOTE: It is possible that both bushing inner sleeves may not butt flush against shaft shoulder. However, when shaft attaching nuts are tightened, bushing inner sleeves will seat themselves.)

9. Remove arm assembly and installer tools from arbor press, and remove spacer tool.

10. Install flat washer and nut on each end of shaft.

(NOTE: Do not torque nuts at this time.)

11. Install upper suspension arm assembly as described in Note 12b.

15. Front Lower Suspension Arm and Coil Spring

(NOTE: To effectively control bumper heights, springs for all models are computer selected according to vehicle weights including all accessories. When replacing springs, be certain to select the proper spring as listed in the Cadillac Parts Manual.)

a. Removal

1. Disconnect front shock absorber at its upper mount.

2. Raise front of car and place jack stands under front frame side rails.

3. Remove wheel assembly.

4. Disconnect stabilizer link from lower arm that is to be removed.

5. Disconnect tie-strut at lower arm.

6. Remove bolt, nut, and washer securing shock absorber to lower arm and remove shock absorber from lower mount.

7. Remove nut from pivot bolt in lower arm at frame mount.

8. Position hydraulic jack under outboard end of lower suspension arm so that jack is supporting arm.

9. Remove locknut from lower spherical joint stud. Install standard nut on joint stud and run nut to within two threads of knuckle.

(NOTE: Nut will prevent lower arm from dropping when joint stud is broken free of steering knuckle.)

10. Strike knuckle with a hammer in area of spherical joint stud to break joint loose. To facilitate removal of joint stud from knuckle, raise opposite rear corner of car to help compress spring.

CAUTION: Use extreme care to prevent hammer from slipping and damaging the brake hose.

11. Use jack to lift spring load from nut and remove nut from joint stud.

12. Slowly lower jack and remove spring.

13. Remove pivot bolt and washer from lower arm at frame mount and remove arm.

b. Installation

1. Position inboard end of lower arm in frame mount and install pivot bolt and washer. Do not install nut at this time.

(NOTE: Raised edge on top of arm faces front of car on right side and rear of car on left side.)

2. Install end of spring in upper seat of frame.

3. With aid of a helper and with jack placed under lower arm, Fig. 3-26, raise arm into position. Spring may have a tendency to rotate as arm is raised, mispositioning spring. Top of spring must seat within the five depressions on frame tower, and bottom end must be one half to one inch back of the front of left lower arm,

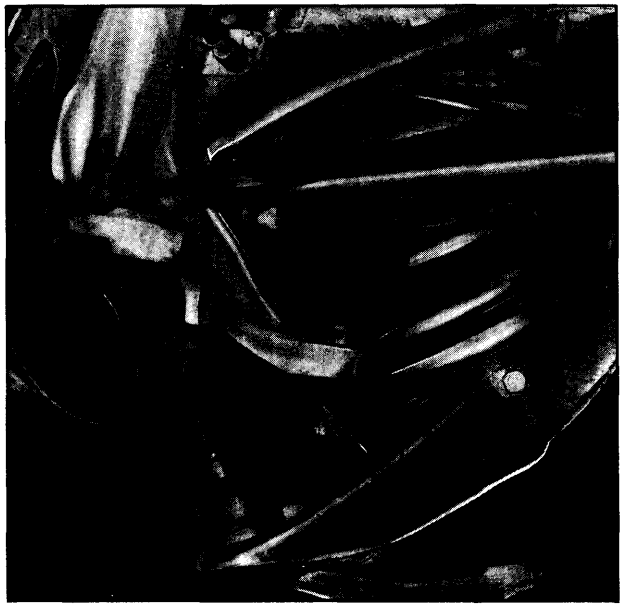


Fig. 3-26 Installing Coil Spring

BACK TO INDEX

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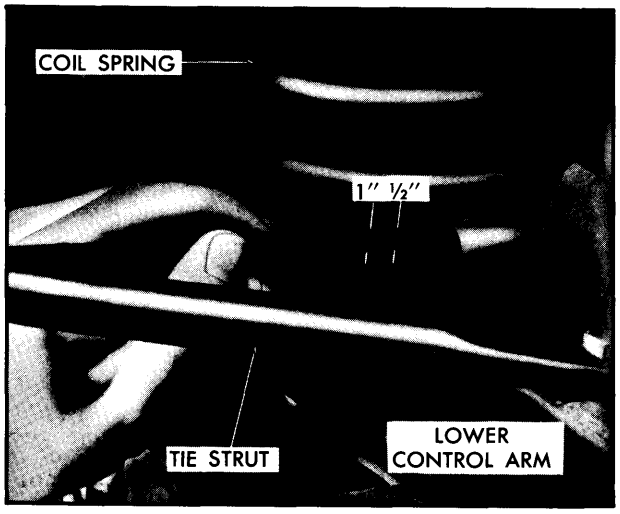


Fig. 3-27 Locating End of Spring

or one half to one inch forward of the back of right lower arm, Fig. 3-27.

4. Guide spherical joint stud into steering knuckle.

5. Install standard nut and an ordinary flat washer on joint stud and tighten nut until joint stud seats in knuckle.

6. Remove standard nut and washer and install locknut on joint stud, tightening to 85 foot-pounds.

CAUTION: See Page 3-6.

7. Install nut on lower suspension arm pivot bolt. Do not tighten this nut until car is on all four wheels.

8. Insert shock absorber assembly up into coil spring and guide stem through tower in frame cross member. Place lower end in position on lower suspension arm. Install pivot bolt, lockwasher, and nut. Do not tighten nut until car is on all four wheels.

9. Install tie-strut on lower arm, securing with two bolts and nuts. Tighten nuts to 55 foot-pounds.

CAUTION: See Page Page 3-6.

10. Connect stabilizer link to lower arm.

11. Install wheel assembly.

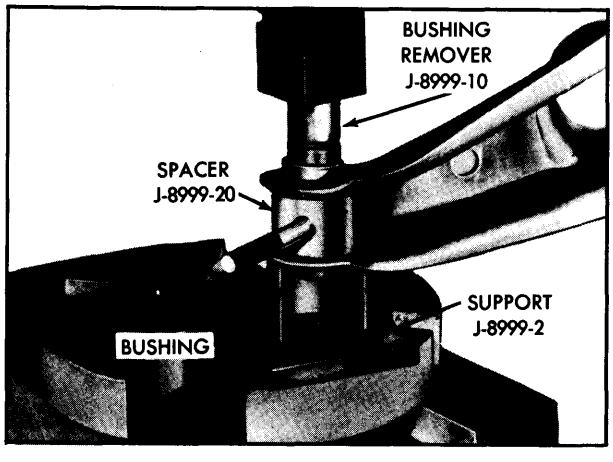


Fig. 3-28 Removing Bushing

12. Replace wheel disc and lower car.

13. Connect shock absorber at upper mount.

14. Tighten nut on lower suspension arm pivot bolt to 95 foot-pounds.

CAUTION: See Page 3-6.

15. Tighten nut at shock absorber lower mount in lower arm to 55 foot-pounds.

CAUTION: See Page 3-6.

16. Front Lower Suspension Arm Bushing

a. Removal

1. Remove lower suspension arm and coil spring as described in Note 15a.

2. Use a stiff wire brush to clean the small outer diameter end of the bushing and the portion of the bushing between the legs of the arm.

(NOTE: This step will help prevent corrosion on the bushing outer sleeve from gouging grooves in the arm upon removal.)

3. Position Support, J-8999-2, on arbor press anvil and insert larger diameter end of bushing in Support.

4. To prevent lower arm from collapsing when bushing is pressed out, place Spacer, J-8999-20, around inner flange of lower control arm. Inner flange is located on larger diameter bushing side.

5. Position Bushing Remover, J-8999-10, on sleeve, Fig. 3-28, and press bushing out of arm.

6. Inspect bushing holes in front lower control arm for distortion of gouges in holes. If arm is damaged, it will be necessary to replace arm.

b. Installation

1. Position Support, J-8999-2, on arbor press anvil and insert smaller diameter flanged end of bushing mount in Support.

2. Install new bushing in arm, smaller diameter end of bushing first, until bushing pilots itself in opposite flanged end.

3. Place Spacer, J-8999-20, around inner flange of lower control arm and insert Spacer, J-8999-23, between bushing flange and control arm, Fig. 3-29.

4. Position Bushing Installer, J-22222-2, over end of bushing and press bushing into arm until bushing flange bottoms on Spacer, J-8999-23.

5. Remove arm assembly and all tools from press.

6. Install lower suspension arm and coil spring as described in Note 15b.

17. Steering Knuckle

a. Removal

1. Remove wheel disc and loosen wheel mounting nuts on side from which steering knuckle is to be removed.

BACK TO INDEX

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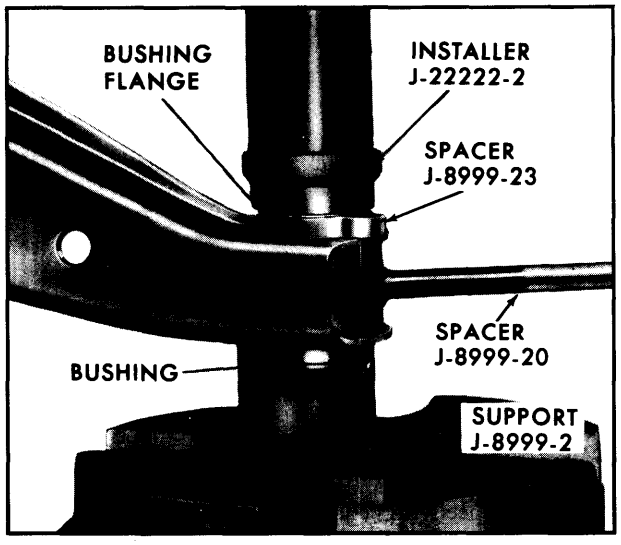


Fig. 3-29 Installing Bushing



Fig. 3-31 Removing Tie Rod

2. Raise front end of car and place jack stands under front frame side rails.

3. Remove wheel mounting nuts and remove wheel and tire.

4. Remove two bolts securing brake caliper to steering knuckle. Slide caliper off disc and use a piece of wire to attach caliper to upper control arm shaft.

CAUTION: Never allow caliper to hang from brake hose, as the brake hose may be damaged.

5. Remove dust cap, cotter pin, spindle nut, and washer.

6. Remove outer cone and bearing assembly.

7. Remove hub and disc assembly from steering knuckle spindle, Fig. 3-30.

8. Remove three screws securing splash shield to steering knuckle, and remove splash shield and seal.

9. Remove cotter pin and nut from tie-rod end stud.

10. Using Puller, J-24319 remove tie-rod joint from steering knuckle, Fig. 3-31.

11. Remove locknut from lower joint stud. Install standard nut on joint stud and run to within two threads of knuckle. Using a hammer, strike knuckle in area of joint stud to break joint loose.

CAUTION: Use extreme care to prevent hammer from slipping and damaging the brake hose.

12. Remove locknut from upper spherical joint stud and, leaving special flat washer in place, install standard nut on joint stud and run nut to within two threads of knuckle.

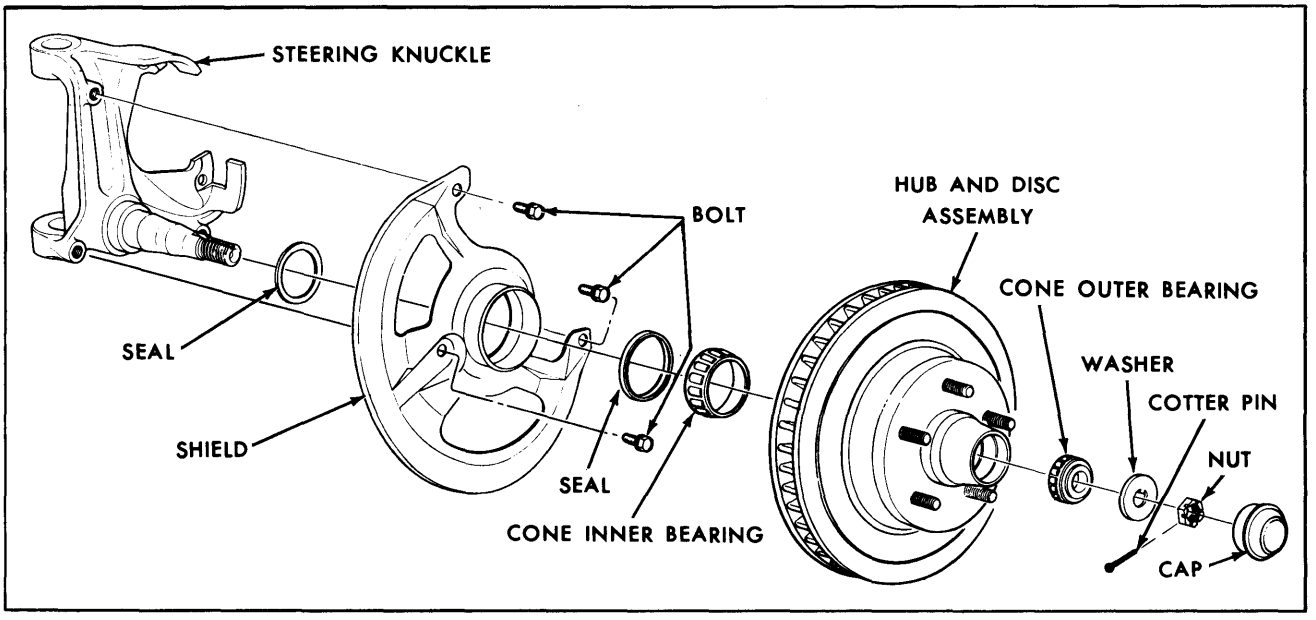


Fig. 3-30 Front Wheel Disassembled

BACK TO INDEX

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13. Using a hammer, strike knuckle in area of joint stud to break joint loose.

CAUTION: Use extreme care to prevent hammer from slipping and damaging the brake hose.

14. Raise the car and move the jack stand from the frame side rail to the lower suspension arm as close under the spherical joint as possible on side from which steering knuckle is to be removed.

15. Remove standard nuts and flat washer, raise up on upper arm, and remove joint stud from end of steering knuckle.

16. Lift steering knuckle off lower joint stud and remove knuckle from car.

b. Installation

1. Guide upper joint stud into steering knuckle upper support and install a standard nut and special flat washer on joint stud. Tighten nut to seat joint stud in knuckle.

2. Remove standard nut and, holding flat washer in place, install locknut, tightening to 60 foot-pounds.

CAUTION: See Page 3-6.

3. Guide lower spherical joint stud into steering knuckle lower support.

4. Install standard nut and an ordinary flat washer on joint stud and tighten until stud seats in knuckle, then remove standard nut and washer and install locknut, tightening to 85 foot-pounds.

CAUTION: See Page 3-6.

5. Install tie-rod end on steering knuckle and install nut. Tighten nut to 37 foot-pounds and install cotter pin.

CAUTION: See Page 3-6.

6. Position seal and splash shield on steering knuckle. Install three screws securing splash shield to steering knuckle and tighten screws to 114 inch-pounds.

7. Install hub and disc assembly on spindle.

8. Install washer and spindle nut, tightening nut with fingers.

9. Install caliper following Steps 1 through 10 of Section 5, Note 12c. Pump brake pedal two or three times to insure a firm pedal.

10. Adjust wheel bearings as in Note 18a.

11. Install wheel and tire and install wheel mounting nuts finger tight.

12. Raise car, remove jack stands, and lower car.

13. Tighten wheel mounting nuts to 130 foot-pounds.

CAUTION: See Page 3-6.

14. Install wheel disc.

15. Check front wheel alignment and adjust as required, Note 2.

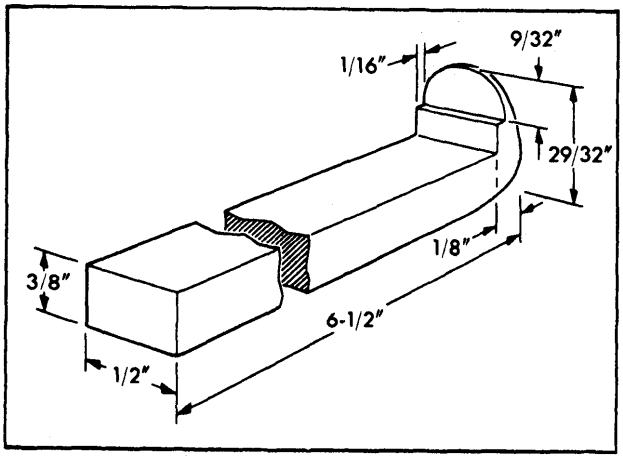


Fig. 3-32 Grease Retainer Removal Tool

18. Front Wheel Bearings

Front wheels are equipped with a set of tapered roller bearings mounted in opposing directions to accommodate various combinations of vehicle loading, Fig. 3-30.

a. Adjustment

1. Raise front of car. Remove wheel disc, dust cap, and cotter pin. Make sure hub is fully seated on spindle.

2. While rotating wheel and tire assembly, tighten spindle nut to 15 foot-pounds to seat all bearing parts.

3. Back off spindle nut until free (approximately one flat) then retighten until nut is finger tight.

4. Install new cotter pin. If pin cannot be installed at finger tight position, back off nut until holes line up and install pin.

5. Spread cotter pin and bend back around sides of nut. Install dust cap and make sure ends of cotter pin do not interfere with dust cap.

CAUTION: Cotter pin must be tight after installation. If pin can be moved with finger, remove pin and install another new cotter pin.

6. Install wheel disc and lower car.

b. Removal

1. Remove wheel disc.

2. Loosen wheel mounting nuts.

3. Raise front end of car.

4. Remove wheel mounting nuts and remove wheel assembly from hub.

5. Remove two bolts securing caliper to knuckle. Slide caliper off disc and use a piece of wire to attach caliper to upper control arm.

CAUTION: Never allow caliper to hang from brake hose, as the hose may be damaged.

6. Remove dust cap, cotter pin, spindle nut, washer, and outer cone and roller assembly, Fig. 3-30.

7. Remove hub and disc assembly from steering knuckle spindle. Take care to prevent damage to spindle threads or grease seal.

8. Remove inner bearing grease seal, and bearing cone and roller assembly.

(NOTE: A simple tool, Fig. 3-32, may be made out of cold rolled steel or from an old screwdriver to facilitate removal of the grease seal. Use of this tool will

BACK TO INDEX

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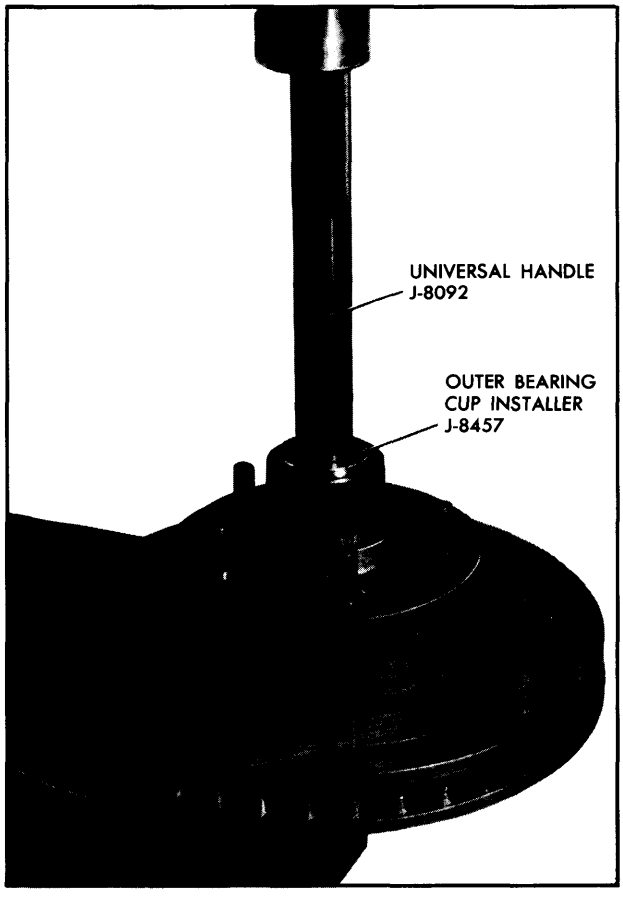


Fig. 3-33 Installing Outer Bearing Cup

prevent possible damage to inner bearing assembly and hub surface when removing seal.)

9. Inner and outer bearing cups are press fit in hub, and can be removed by driving out from opposite side with a long brass drift. Tap alternately on opposite sides of cup to avoid cocking cup and damaging inside of hub.

(NOTE: Discolored stripes on bearing cups, particularly on low mileage cars, do not necessarily indicate a rough bearing race. If stains can be removed by light polishing, replacement is not required. See Fig.

c. Cleaning and Inspection

1. Clean bearing cone assemblies and cups thoroughly with clean solvent. Replace complete assembly if any parts are worn, pitted, or rough.

2. Inspect bearing cups and hub surfaces carefully for nicks or small particles of foreign material. All seating surfaces must be absolutely smooth.

3. If bearing cup O.D. is scored, or if bearing cup separated very easily from housing, a loose housing fit is indicated. Examine hub bearing surfaces to assure proper bearing cup seating and fit. Replace hub and disc assembly if necessary.

4. Examine spindle bearing seats for excess wear or damage that could prevent proper slip fit seating of cone assemblies. Replace steering knuckle if necessary.

d. Installation

1. Lubricate spindle and hub bore with thin film of #2 grade lithium high melting point wheel bearing grease to prevent rust. Excess grease should be avoided to reduce possibility of leakage.

2. Install outer bearing cup, using Front Hub Outer Bearing Cup Installer, J-8457, and Handle, J-8092. Use arbor press to install bearing cup in hub, Fig. 3-33.

3. Install inner bearing cup, using Front Hub Inner Bearing Cup Installer, J-8458, and Handle, J-8092. Use arbor press to install bearing cup in hub, Fig. 3-34.

4. Pack bearing cone and roller assemblies with #2 grade lithium high melting point wheel bearing grease. Use a commerical bearing packer or pack bearings by hand. Force grease in at large end of roller cage until grease protrudes from small end.

5. Place inner bearing cone and roller assembly in inner bearing cup.

6. Install new grease seal using a flat plate until seal is flush with hub. One way to perform this step is to screw Seal Installer, J-23114, into Universal Handle, J-8092, with flat side away from Handle. Then use arbor press to install grease retainer in hub, Fig. 3-35.

7. Carefully install hub and disc assembly on spindle.

8. Place outer bearing cone and roller assembly in outer bearing cup.

9. Install washer and spindle nut, tightening nut with fingers.

10. Install caliper as described in Section 5, Note 12c, Steps 1 through 10 and Step 20.

11. Install wheel and tire assembly on hub and install wheel mounting nuts finger tight.

12. Adjust wheel bearings as in Part a.

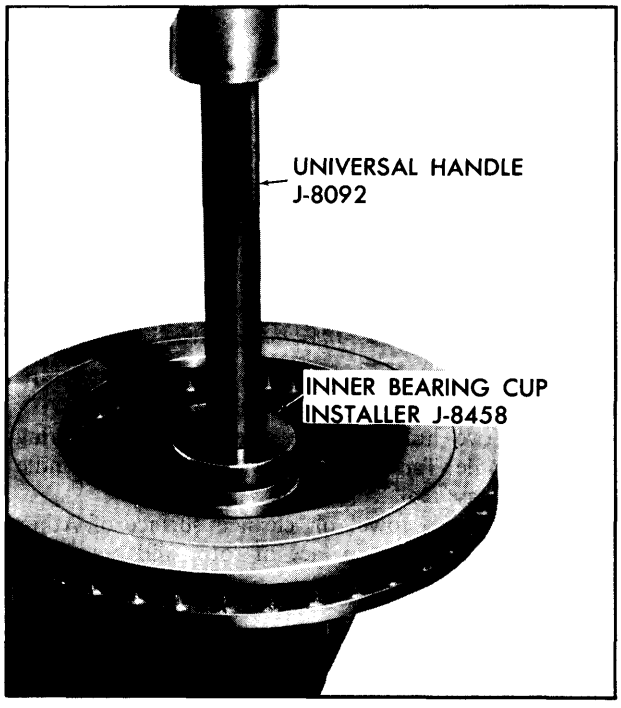


Fig. 3-34 Installing Inner Bearing Cup

BACK TO INDEX

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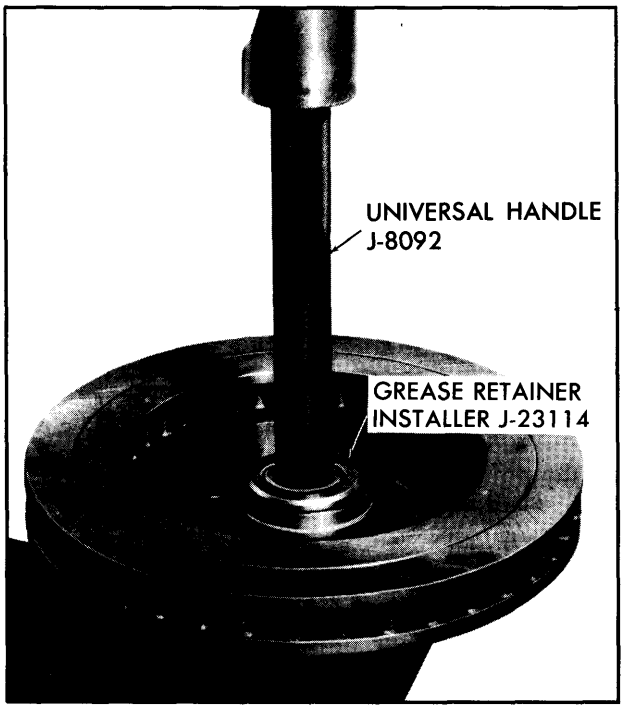


Fig. 3-35 Installing Grease Retainer

13. Lower car and tighten wheel mounting nuts to 130 foot-pounds.

CAUTION: See Page 3-6.

14. Install wheel disc.

19. Front Wheel Stud Replacement (Off-Car)

a. Removal

1. Remove wheel disc.
2. Loosen wheel mounting nuts.
3. Raise front end of car.
4. Remove wheel mounting nuts and remove wheel assembly from hub.
5. Remove two bolts securing caliper to knuckle. Slide caliper off disc and use a piece of wire to attach caliper to upper control arm.

CAUTION: Never allow caliper to hang from brake hose, as the hose may be damaged.

6. Remove dust cap, cotter pin, spindle nut, washer, and outer cone and roller assembly.
7. Remove hub and disc assembly from steering knuckle spindle. Take care to prevent damage to spindle threads or grease seal.
8. Place shop towel on cleaned surface of Arbor Press to avoid damage to face of rotor and press stud out, Fig. 3-36.

b. Installation

1. Carefully install hub and disc assembly on spindle.
2. Place outer bearing cone and roller assembly in outer bearing cup.
3. Install washer and spindle nut, tightening nut with fingers.
4. Position caliper on disc and line up holes in caliper ears with holes in steering knuckle.
5. Lubricate both ends of caliper bolts with silicone lubricant.
6. Start either bolt into inboard ear of caliper and outboard ear of shoe into steering knuckle. At this point it is necessary to be sure that bolt passes under retaining ear on inboard shoe to maintain shoe in position in caliper.
7. Pass bolt on through outboard ear on caliper until threads on bolts can be started into steering knuckle.
8. Repeat steps 7 and 8 in placing remaining bolt into caliper assembly.
9. Tighten caliper mounting bolts to 30 foot-pounds.
10. Before moving car, pump brake pedal two or three times to insure a firm pedal.
11. Install new stud from back side of hub.
12. Install two flat washers on stud and wheel nut, flat side toward washers, and tighten nut with fingers.
13. With the aid of a suitable holding tool, torque nut to 140 foot-pounds, Fig. 3-37.
14. Remove nut and washers from stud and discard.
15. Visually check stud threads and stud for being properly seated on inside of hub.
16. Install wheel and tire assembly on hub and install wheel mounting nuts finger tight.
17. While rotating wheel and tire assembly, tighten spindle nut to 15 foot-pounds to seat all bearing parts.
18. Back off spindle nut until free (approximately one flat) then retighten until nut is finger tight.
19. Install new cotter pin. If pin cannot be installed at finger tight position, back off nut until holes line up and install pin.
20. Spread cotter pin and bend back around sides of

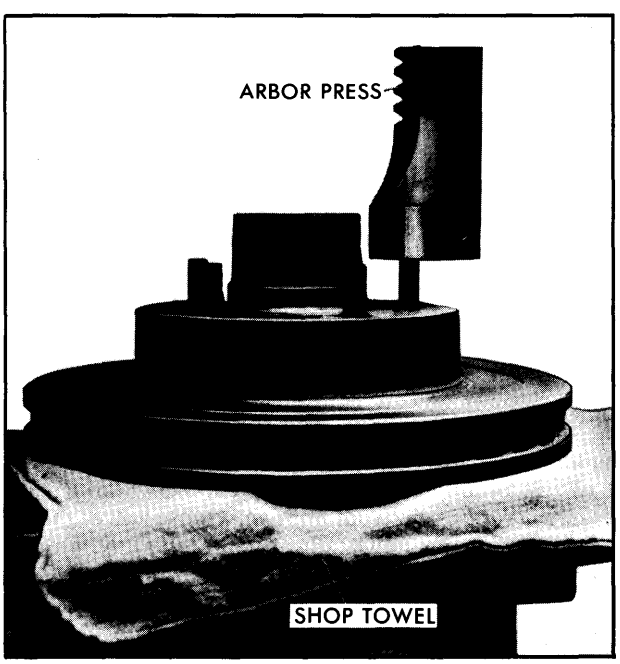


Fig. 3-36 Removing Wheel Stud

BACK TO INDEX

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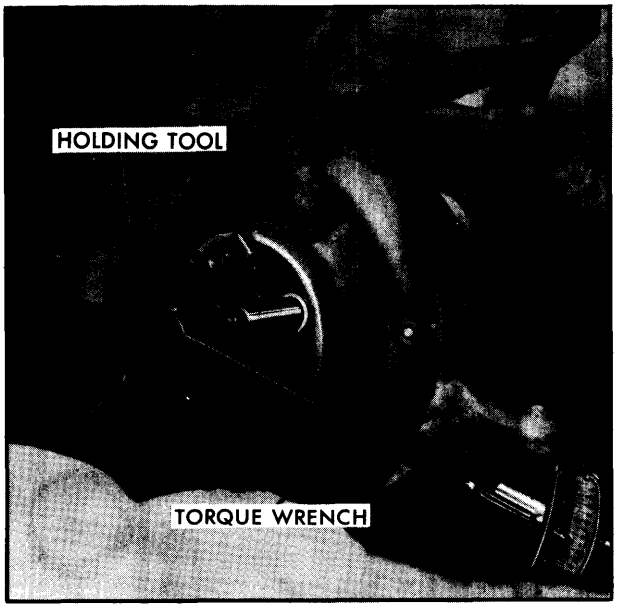


Fig. 3-37 Installing Wheel Stud

nut. Install dust cap and make sure ends of cotter pin do not interfere with dust cap.

CAUTION: Cotter pin must be tight after installation. If pin can be moved with finger, remove pin and install another new cotter pin.

21. Install wheel assembly on hub.
22. Install wheel mounting nuts, Torque to 130 foot-pounds.

CAUTION: *See page 3-6.*

23. Drive car around several blocks making left hand and right hand turns.
24. Re-torque wheel mounting nuts to 130 foot-pounds.
25. Install wheel disc.

TORQUE SPECIFICATIONS (EXCEPT ELDORADO)

Material No.	Application	Tread Size	Foot-Pounds
301-M	Spherical joint to knuckle (lower)	9/16-18	85*
301-M	Spherical joint to knuckle (upper)	1/2-20	60*
GM6010-M	Stabilizer bracket to frame attaching screws	3/8-16	35
301-M	Suspension arm shaft to frame nuts (upper)	1/2-20	85*
286-M	Suspension arm shaft attaching nuts (at bushings) 1-1/4"	3/4-16	85*
301-M	Suspension arm to frame (lower)	9/16-12	95*
301-M	Front shock absorber to lower arm nut	7/16-14	55
286-M	Tie rod adjuster clamp nuts	3/8-24	22
301-M	Tie rod pivots to steering knuckle	1/2-20	37*
301-M	Tie-strut to lower arm	7/16-20	55*
284-M	Tie-strut to frame at front bushing	3/4-16	50*
286-M	Wheel mounting nuts	1/2-20	130*
			Inch-Pounds
SAE 1110-1112	Front shock absorber upper stem nut	3/8-24	180
SAE 1110	Front stabilizer link nut	5/16-24	150
284-M	Front stabilizer link locknut	5/16-24	150
275-M	Splash shield to steering knuckle screws	1/4-20	114

**CAUTION: These fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. Each must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.*

BACK TO INDEX

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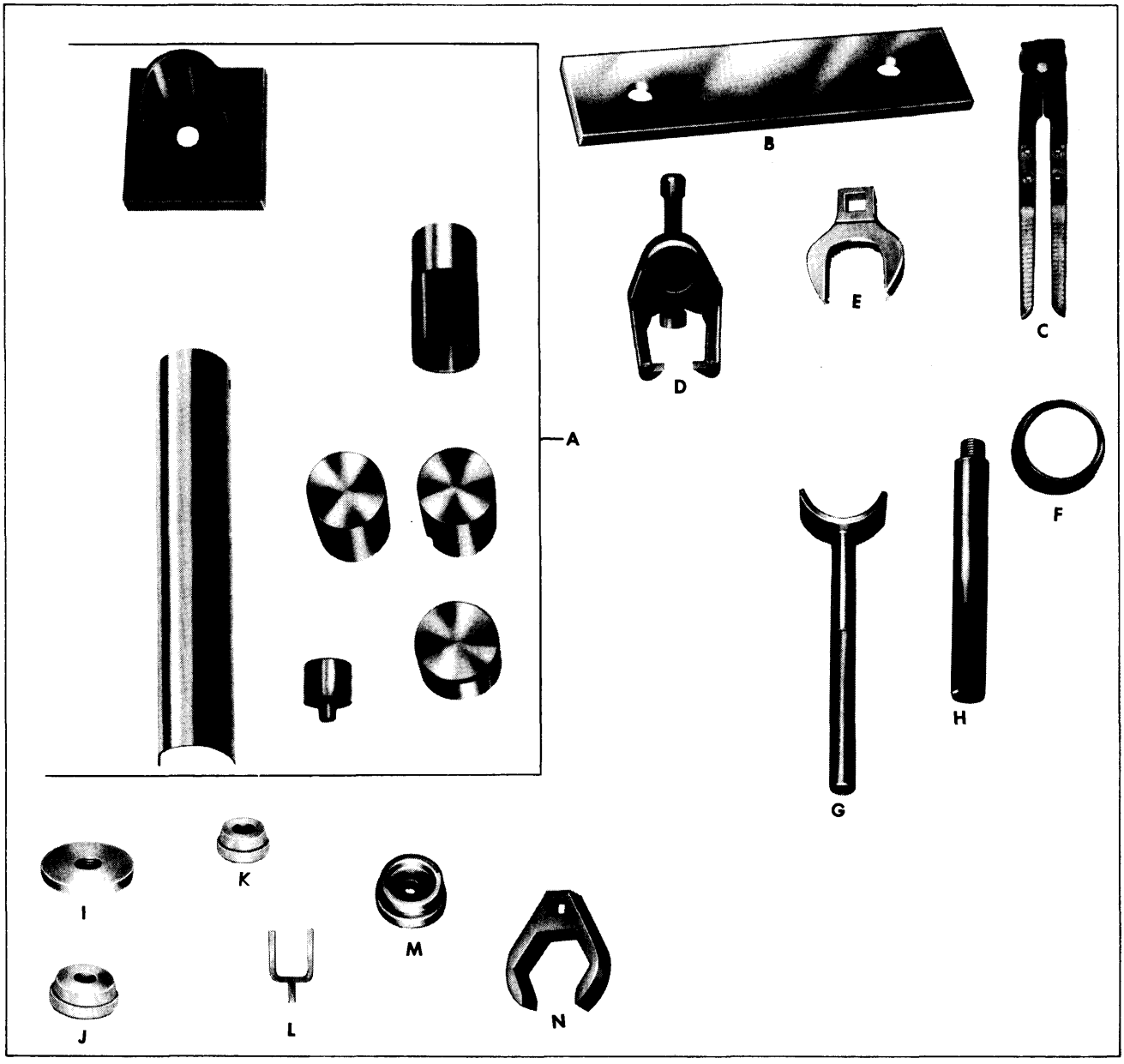


Fig. 3-38 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-8999	Front Suspension Service Set	H	J-8092	Universal Handle
B	None	Bushing Remover Spacer (2)	I	J-23114	Front Hub Grease Retainer Installer
C	J-22610	Band Installer	J	J-8458	Front Hub Inner Bearing Cup Installer
D	J-24319-01	Puller Front Suspension	K	J-8457	Front Hub Outer Bearing Cup Installer
E	J-23415	Camber Adjustment Wrench	L	J-8999-23	Spacer
F	J-9148	Garter Spring Installer	M	J-22222-2	Bushing Installer
G	J-8999-20	Spacer	N	J-24515	Caster Adjusting Wrench

BACK TO INDEX

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GENERAL DESCRIPTION

The service information that follows pertains only to the Eldorado. All other service procedures and recommendations for the Eldorado are the same as those for the standard car, as given in the first part of this section.

The front suspension on the Eldorado consists of two upper and two lower control arms, a stabilizer bar, shock absorbers, and a right and left torsion bar, Fig. 3-40. Torsion bars are used instead of coil springs. The front end of the torsion bar is attached to the lower control arm. The rear of the torsion bar is mounted into an adjustable arm in the torsion bar cross member. The standing height of the car is controlled by the adjuster bolt and nut that positions the adjuster arm.

CAUTION: If any mispositioning, incorrect assembly, or failure of components in the area of the brake system pipes, hoses, or cylinders is observed, be sure to check for any brake damage that may have resulted from such a condition, and correct as required. Components that could damage the brake system due to mispositioning, incorrect assembly, or failure include the exhaust system, shock absorbers, torsion bars, suspension control arms, stabilizer bar, power steering pump hoses, and transmission cooler pipes.

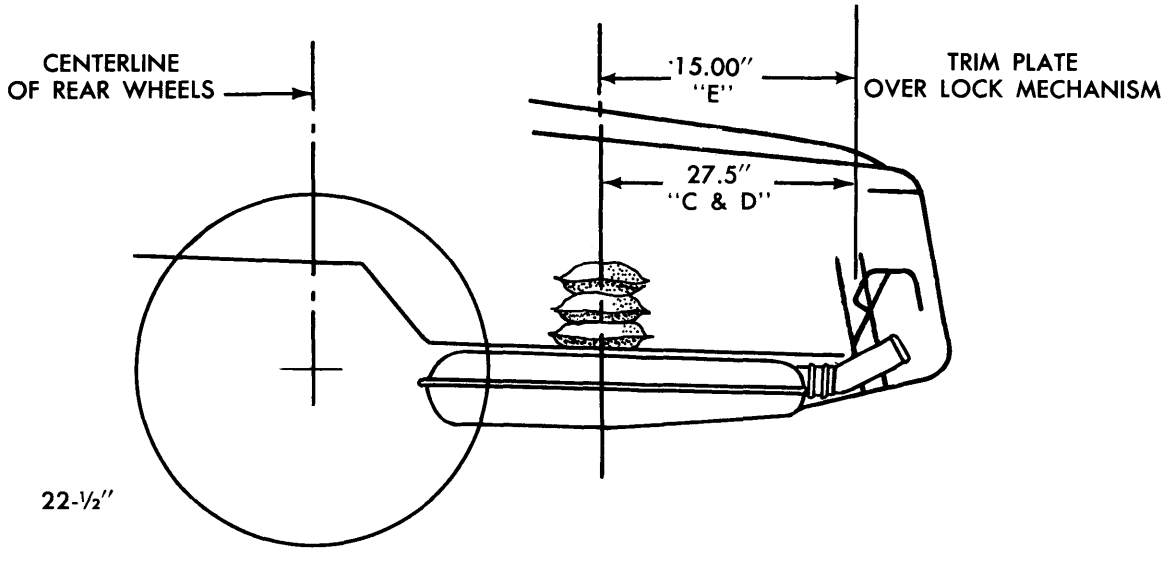
SERVICE INFORMATION

20. Standing Height Adjustment (Eldorado)

The standing height must be checked, and adjusted if necessary, before performing the front end alignment procedure. The standing height is controlled by the adjustment setting of the torsion bar adjusting bolt.

Clockwise rotation of the bolt increases the front height; counterclockwise decreases the front height.

Car must be on a level surface, gas tank full (or a compensating weight added as shown in Fig. 3-39), front seat all the way to the rear, and front and rear tires inflated to the proper pressures. Refer to Tire Pressure



	FUEL GAGE READING	AMOUNT OF WEIGHT (BAGS OF SHOT OR EQUIVALENT)
ALL SERIES	FULL	0
	¾	40 LBS.
	½	75 LBS.
	¼	110 LBS.
	ALMOST EMPTY	150 LBS.

Fig. 3-39 Compensating Weights

BACK TO INDEX

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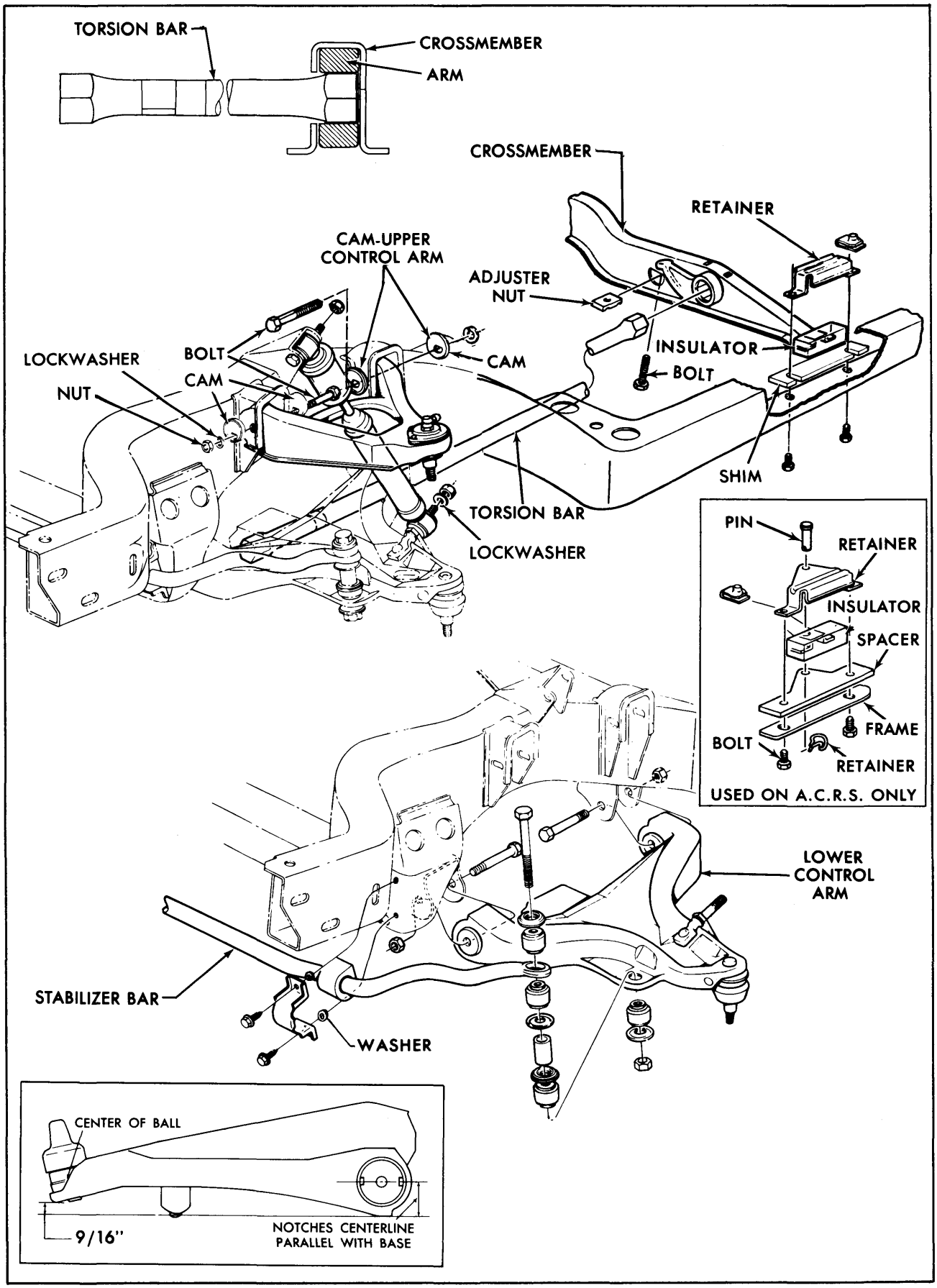


Fig. 3-40 Eldorado Front Suspension—Disassembled

BACK TO INDEX

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Chart, Fig. 10-1. Both doors must be closed and no passengers or additional weight should be in car or trunk.

It is recommended that a wheel alignment pit be used for checking standing heights rather than channel type hoists due to the possibility of hoist deflection under vehicle weight, which distorts the standing height measurements.

To measure standing heights check the frame to axle clearance (rear) and lower edge of front shock absorber dust tube to centerline of lower attachment (front).

Standing height specifications for the Eldorado are including in Fig. 3-2.

(NOTE: Before checking rear standing height, loosen air line connection to shock absorbers to remove all air from shock absorbers. Also, be sure to bounce front of car several times, gradually reducing bouncing effort, to normalize standing height.)

After standing height is adjusted, check and adjust front wheel alignment as described in Note 20.

21. Front Wheel Alignment (Eldorado)

Satisfactory vehicle operation may occur over a wide range of front end (wheel) alignment settings. Nevertheless, should settings vary beyond certain tolerances, readjustment of alignment is advisable. The specifications stated in column 2 of the specifications chart, Fig. 3-41, should be used by owners, dealers, and repairmen as guidelines in vehicle diagnosis either for repairs under the new warranty or for maintenance service at customer's request. These specifications provide an acceptable all-around operating range in that they prevent abnormal tire wear caused by wheel alignment.

Governmental Periodic Motor Vehicle Inspection programs usually include wheel alignment among items that are inspected. To provide useful information for such inspections, the specifications stated in column 3 of the specification chart are given and these are well within the range of safe vehicle operation.

ELDORADO WHEEL ALIGNMENT SPECIFICATIONS*

	① SPECIFICATIONS FOR RESETTING ALIGNMENT	② TOLERANCE FOR DIAGNOSIS FOR WARRANTY REPAIRS OR CUSTOMER PAID SERVICE	③ TOLERANCE FOR PERIODIC MOTOR VEHICLE INSPECTION
Camber	LH $0^{o} \pm 3/8^{o}$ RH $-1/4^{o} \pm 3/8^{o}$	$\pm 3/4^{o}$	$\pm 1\ 1/2^{o}$
Cross Camber (LH Minus RH)	$1/4^{o} \pm 1/2^{o}$	$\pm 1^{o}$**	–
Caster	$0^{o} \pm 1/2^{o}$	$\pm 1^{o}$	$\pm 2^{o}$
Cross Caster (LH Minus RH)	$0^{o} \pm 1/2^{o}$	$\pm 1^{o}$**	–
Toe-In	$0" \pm 1/16"$	$\pm 1/8"$	$\pm 3/8"$

*Vehicle must have full lubricant, coolant and fuel levels with no passengers or luggage.

** Cross camber and cross caster not to exceed 1^{o} maximum per vehicle.

Fig. 3-41 Eldorado Wheel Alignment Specifications

BACK TO INDEX

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In the event the actual settings are beyond the specifications set forth in column 2 or 3 (whichever is applicable), or whenever for other reasons the alignment is being reset, Cadillac recommends that the specifications given in column 1 of the specification chart be used.

a. Sequence of Operation

(Front wheel alignment must be checked whenever the vehicle standing height is changed.)

Front wheel alignment must be performed in the exact sequence as described in this procedure. Wheel alignment equipment manufacturers provide detailed instructions for checking wheel alignment with their alignment equipment. These instructions should be carefully followed.

In addition to the manufacturer's instructions, be sure to observe the following recommendations:

(NOTE: Car must be on a level surface, gas tank full or a compensating weight added as shown in Fig. 3-39 front seat all the way to the rear, and front and rear tires inflated to the proper pressures. Refer to Tire Placard Label in the glove box. Both doors must be closed and no passengers or additional weight should be in car or trunk.

1. Drive car to determine whether steering wheel is properly centered. If correction is needed, mark the straight ahead position with tape so that the change required can be made during the toe-in adjustment.
2. Check the front standing height and adjust, if necessary. Refer to Note 20.
3. Check front wheel alignment and adjust as required following procedure recommended by manufacturer of alignment equipment.
4. After removing vehicle from alignment machine, check the straight ahead position of the steering wheel to determine if it is properly centered. If further correction is required, repeat the toe-in portion of the wheel alignment procedure so that the necessary changes can be made.

b. Camber and Caster (Fig. 3-42)

(These adjustments can be made either from under car or under hood, as desired. If under hood approach is used, however, be sure to recheck alignment after all operations are completed. Change in weight distribution caused by opened hood is sufficient to disturb final alignment settings.)

1. Loosen nuts on upper control arm front and rear cam bolts.
2. Note camber reading and rotate front bolt to correct for 1/2 of incorrect reading or as near as possible.
3. Rotate rear cam bolt to bring camber reading to 0°.

CAUTION: Do not use a socket to adjust rear cam bolt on left side as brake pipes could be damaged. An offset box end wrench is recommended at this adjustment point.

4. Tighten front and rear bolts and check caster.

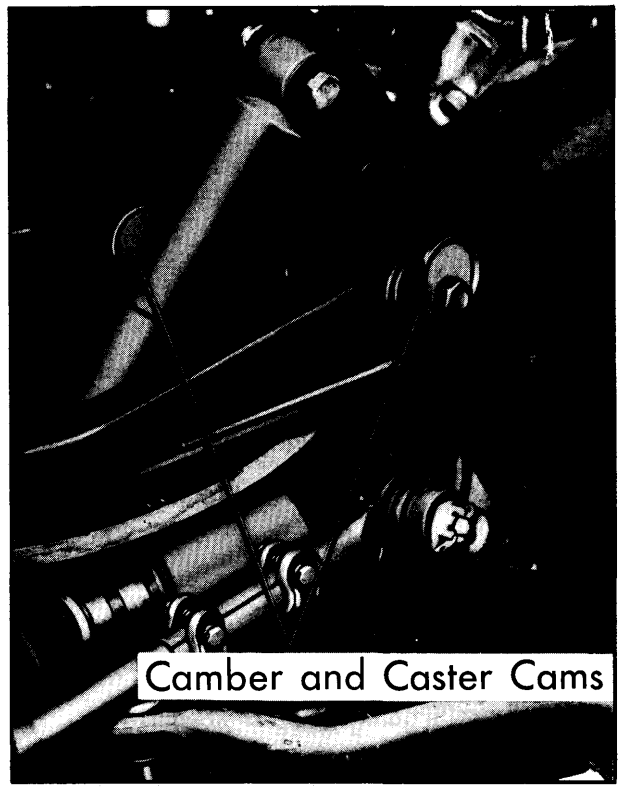


Fig. 3-42 Camber and Caster Cam Location

(NOTE: If caster requires adjustment, proceed with step 5; if not, move to step 8.)

5. Loosen front and rear cam bolt nuts.
6. Using camber scale on alignment equipment, rotate front bolt so that the camber changes an amount equal to 1/4 of the desired caster change. (A caster change-to-camber change ratio of about 2 to 1 is inherent to the Eldorado suspension system. That is, when one cam is rotated sufficiently to change camber 1°, caster reading will change about 2°.)

(NOTE: If adjusting to correct for excessive negative caster, rotate front bolt to increase positive camber. If adjusting to correct for excessive positive caster, rotate front bolt to increase negative camber.)

7. Rotate the rear bolt until camber setting returns to its corrected position (Step 3).
8. Tighten upper control arm cam nuts to 95 foot-pounds. Hold head of bolt securely; any movement of the cam will affect final setting and will require a recheck of the camber and caster adjustments.

CAUTION: See Page 3-6.

c. Toe-In

Before checking toe-in, make certain that the drag link height is correct. See Section 9, Note 5 for drag link height.

Toe-in is adjusted by turning the tie-rod adjuster tubes at the outer ends of each tie rod after loosening clamp bolts. The readings should be taken only when the front wheels are in a straight ahead position so that the steering gear is on its high spot.

BACK TO INDEX

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1. Center steering wheel, raise car, and check wheel run-out.
2. Loosen tie-rod adjuster nuts and adjust tie-rods to obtain proper toe-in setting.
3. Position tie-rod adjuster clamps so that openings of clamps are facing up. Interference with front suspension components could occur while turning if clamps are facing down.
4. Tighten tie-rod adjuster nuts to 22 foot-pounds.

22. Front Shock Absorber

a. Removal

(NOTE: Perform work on platform type hoist or garage floor so that vehicle weight is on the front suspension.)

1. Disconnect shock absorber at upper and lower mount.
2. Compress shock absorber and work lower mount free from mount bolt using a screwdriver placed inside the mount inner sleeve for leverage.
3. Guide shock absorber down and toward rear of car, and remove from car.

b. Installation

1. Guide shock absorber up through upper control arm.
2. Position shock absorber on lower attaching stud, using screwdriver inside mount inner sleeve to facilitate bushing installation.
3. Extend upper shock absorber mount into frame attaching bracket using body weight on fender to compress suspension to assist in lining up mounting holes.
4. Install shock absorber upper attaching bolt and nut. Tighten nut to 75 foot-pounds.
5. Install lockwasher and lower attaching nut and tighten to 75 foot-pounds.

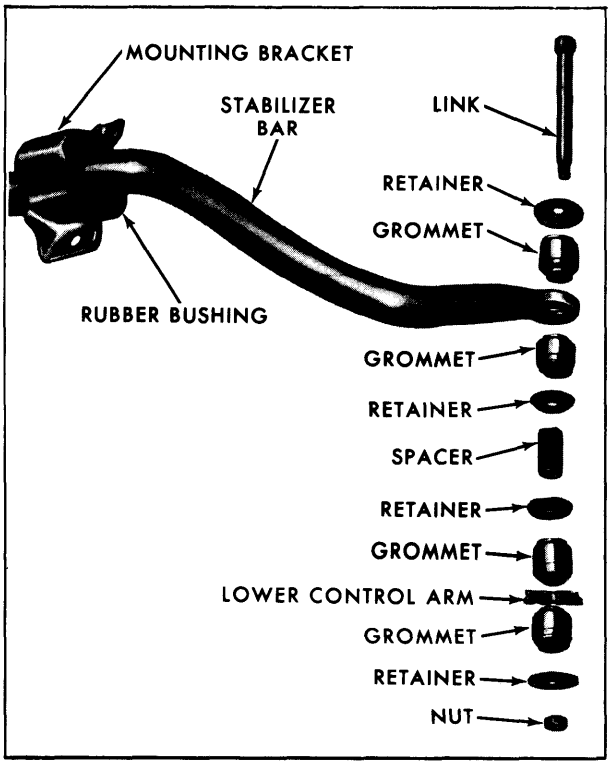


Fig. 3-43 Front Stabilizer Linkage

23. Stabilizer Bar

a. Removal

1. Place car on jack stands.
2. Remove link bolts, nuts, grommets, spacers, and retainers from lower control arm. Discard bolts and nuts.
3. Remove bracket to frame attaching bolts and remove stabilizer bar from car.

b. Installation

1. Position stabilizer bar in place on car.

(NOTE: Stabilizer bar grommets and retainers are larger than those used in other applications. Replacement parts must be of this larger design.)

2. Assemble grommets, spacers, and retainers on new link bolt as shown in Fig. 3-43.
3. Position link bolt on lower control arm, and install remaining grommet, retainer, and nut.
4. Install stabilizer to frame brackets.
5. Tighten stabilizer link nuts to 156 inch-pounds.
6. Cut off or file link bolt threads flush with head of nut.

CAUTION: Failure to cut off excess bolt threads could result in front tire damage under extreme operating conditions.

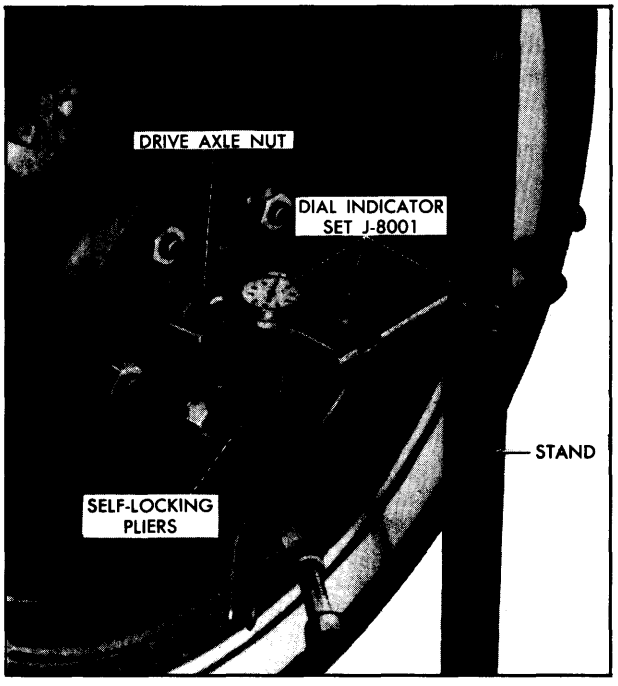


Fig. 3-44 Checking Spherical Joint

BACK TO INDEX

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24. Spherical Joint Checking Procedure

1. Raise car and position jack stands under lower control arms as near as possible to each spherical joint. Car must be stable and should not rock on floor stands.
2. Clamp self-locking pliers on hub to drive axle nut so that self-locking pliers are in horizontal position, Fig. 3-44.
3. Construct a sturdy stand and install Dial Indicator, J-8001, so that indicator is horizontal and button contacts pliers, Fig. 3-44. Set dial to 0.
4. Place a pry bar between lower control arm and drive axle outer race as shown in Fig. 3-45, and pry down on bar. If reading exceeds .125" replace lower spherical joint. (Very little prying effort is necessary to make this check. Often, weight of pry bar itself is all that is required.)

CAUTION: When positioning pry bar, use extreme caution to avoid contact with drive axle seal, as seal may become damaged internally.

25. Upper Control Arm Bushing (On Car)

a. Removal

The upper control arm bushings can be removed and installed on or off the car.

1. Remove wheel disc.
2. Loosen wheel mounting nuts.
3. Raise car and remove wheel and tire.
4. Disconnect shock absorber at upper mount and remove nut and bolt.
5. Remove upper control arm cam assemblies and nuts.
6. Remove upper control arm from frame mounts.
7. Attach bushing removal tools as shown in Fig. 3-46.

(NOTE: Spray bushings with silicone lubricant to facilitate removal.)

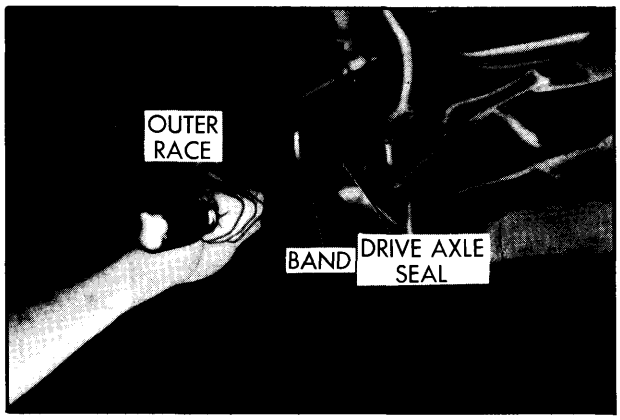


Fig. 3-45 Prying Drive Axle

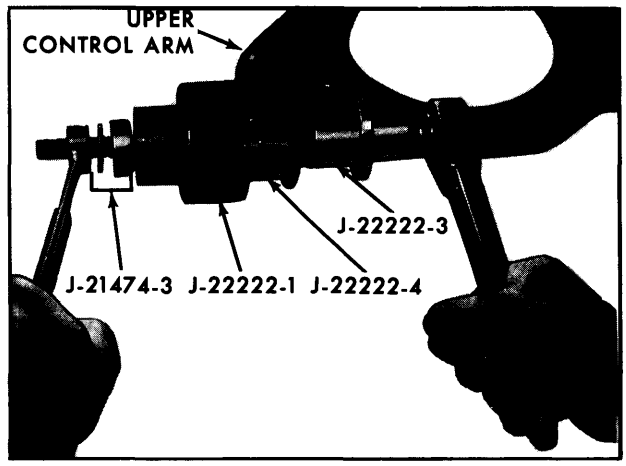


Fig. 3-46 Removing Control Bushings

8. Remove bushings and remove tools.

b. Installation

(NOTE: Spray bushings with silicone lubricant to facilitate installation.)

1. Place bushings in control arm.
2. Install tools as shown in Fig. 3-47 and press bushings into control arm.
3. Remove bushing installation tools.
4. Guide upper control arm over shock absorber and install bushing ends into frame mounts.
5. Install cam assemblies as shown in Fig. 3-42. Both front and rear cams should be mounted with bolt hole downward.
6. Install shock absorber in upper mount. Tighten nut to 75 foot-pounds.
7. Install wheel and tire.
8. Lower car and tighten wheel mounting nuts to 130 foot-pounds.

CAUTION: *See Page 3-6.*

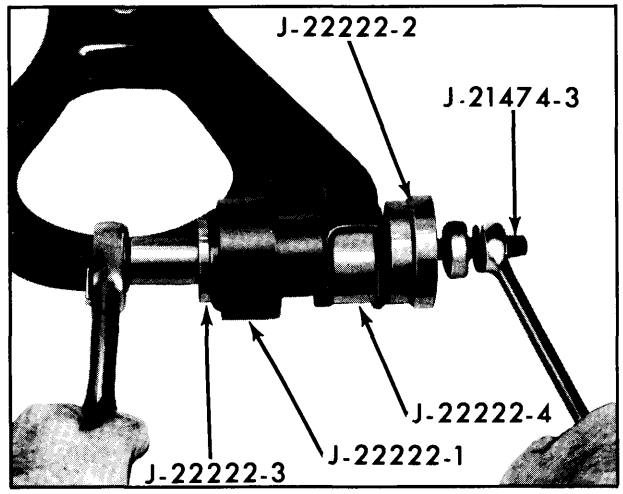


Fig. 3-47 Installing Control Arm Bushings

BACK TO INDEX

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9. Check standing height as described in Note 20 and adjust if necessary.

10. Adjust toe-in, caster, and camber as described in Note 21.

11. Install wheel disc.

26. Upper Control Arm

a. Removal

The upper control arm can be serviced either as an assembly, or by its component parts. If it is not necessary to replace the control arm as an assembly, there are two service packages available. One package contains bushings only, the other package consists of a spherical joint, two bolts, one nut, and a cotter pin.

1. Remove wheel disc.
2. Loosen wheel mounting nuts.
3. Raise car. Support on jack stands located under lower suspension arms as close to spherical joints as possible.
4. Remove wheel mounting nuts and remove wheel and tire.
5. Disconnect shock absorber at upper mount.
6. Remove cotter pin and nut on upper spherical joint.
7. Remove brake hose clip from spherical joint stud.
8. Remove two bolts securing brake caliper to steering knuckle and slide caliper off disc. Use a piece of wire to attach caliper to frame.

CAUTION: Do not allow caliper to hang from brake line, as the line may be damaged.

9. Disengage spherical joint stud and remove from steering knuckle.
10. Remove upper control arm cam assemblies and remove control arm from car.

b. Installation

1. Guide upper control arm over shock absorber and install bushing ends into frame mounts.
2. Install cam assemblies as shown in Fig. 3-42. Both cams should be mounted with bolt hole downward.
3. Install shock absorber in upper mount. Tighten nut to 75 foot-pounds.
4. Install upper spherical joint into steering knuckle.
5. Install brake caliper following procedure in Section 5, Note 12c, Steps 1 through 10, and Step 20.

CAUTION: Do not twist brake hose on installation, as brake system damage may result.

6. Install brake hose clip, nut, and cotter pin on upper spherical joint stud. Tighten nut to 60 foot-pounds.

CAUTION: See Page 3-6.

CAUTION: Cotter pin must be crimped toward upper control arm to prevent damage to the outer constant velocity joint seal. If cotter pin cannot be installed in this position, tighten nut further until insertion is possible.

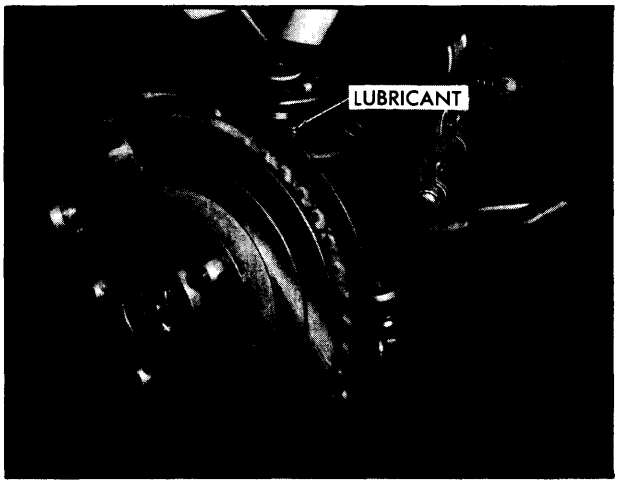


Fig. 3-48 Repacking Upper Spherical Joint

7. Install wheel and tire. Tighten nuts to 130 foot-pounds.

CAUTION: See Page 3-6.

8. Raise car. Remove jack stands and lower car.
9. Check standing height as described in Note 20 and adjust.
10. Check caster, camber, and toe-in as described in Note 21 and adjust.

27. Upper Control Arm Spherical Joint

a. Removal

1. Remove upper control arm as described in Note 26a.

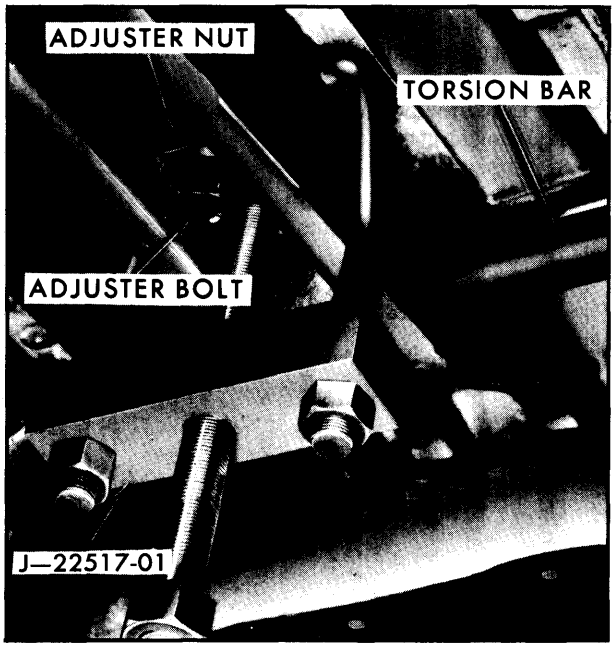


Fig. 3-49 Removing and Installing Torsion Bar

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2. Place upper control arm on workbench and grind the heads off three rivets.
3. Using a hammer and punch, drive on center of rivets until spherical joint can be removed from control arm.

b. Installation

1. Install new spherical joint in upper control arm.
2. Install four bolts in top side of control arm.
3. Install four nuts from under side of control arm. Tighten nuts to 25 foot-pounds.
4. Install upper control arm as described in Note 26b.

CAUTION: See Page 3-6.

5. Lubricate joint using special lubricant recommended for this application until lubricant escapes between seal and steering knuckle, Fig. 3-48.

28. Torsion Bar

a. Removal

1. Raise car so that front suspension is allowed to hang at full rebound position.
2. Remove adjusting bolt from both torsion bar adjuster nuts.
3. Install Torsion Bar Remover and Installer, J-22517-01, on torsion bar cross member, Fig. 3-49.

(NOTE: Install Torsion Bar Remover U-bolt on cross member. If clearance is insufficient, pry between cross member and underbody until tool falls in place, Fig. 3-50. Next, install Torsion Bar Remover Base on U-bolt and install two locknuts on U-bolt. Make certain Base is installed flush with last thread on U-bolt and install center bolt.)

4. Tighten center bolt until torsion bar adjusting arm is raised high enough to permit removal of adjuster nut. Remove adjuster nut.
5. Loosen remover tool center bolt until it is free of the adjusting arm.
6. Repeat Steps 3 and 4 on other end of cross member and remove tool from cross member.
7. Remove parking brake cable from guide at right side of underbody.

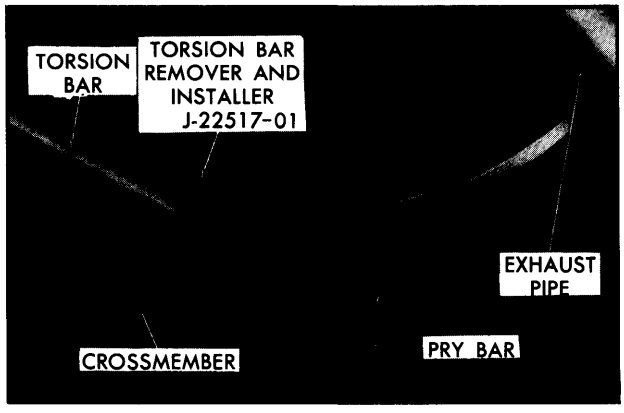


Fig. 3-50 Prying at Crossmember and Underbody

8. Remove torsion bar cross member bolts, nuts, shim, and retainer from both ends of cross member.
9. Move cross member as far as possible toward the side opposite the side from which torsion bar is to be removed. One end of cross member should now be clear of frame.
10. Lower end of cross member from frame, then drive cross member rearward until torsion bar is free of cross member.

CAUTION: Take care not to damage parking brake cable when lowering cross member. If additional slack is required, loosen parking brake cable adjustment nut at equalizer.

(NOTE: Although it is possible to remove both torsion bars at this point, installation is easier if either left or right bar is mounted at all times.)

11. Remove torsion bar from connector at lower control arm.

b. Installation

1. Check torsion bar for deep nicks, scratches, dents, or splits along the seam. If these conditions exist, torsion bar must be replaced.
2. Lubricate three inches of each end of torsion bar with special lubricant, Part No. 998 5092 or equivalent.

(NOTE: Torsion bars are stamped with letters "L" for left and "R" for right. The stamped end is installed in the lower control arm connector.)

3. Slide torsion bar all the way into lower control arm connector.
4. Position torsion bar adjusting arm in cross member. Holding adjusting arm in place, slide torsion bar rearward until bar is seated in adjusting arm.

At this point, tape on torsion bar near lower control arm connector should be fully visible but within 1/4" of connector.

5. Position cross member on frame.

(NOTE: If both torsion bars are to be removed, remove opposite bar at this time following procedure of Part a, beginning with Step 9.)

6. Install shim between cross member and frame on each side, and install retainer over cross member insulator.
7. Check both torsion bar adjusting arms for identical position with respect to torsion bar and cross member. Install cross member bolts and nuts, tightening to 120 inch-pounds.
8. Install parking brake cable through guide at right side of underbody. If cable was loosened at equalizer, adjust at this time, Section 5, Note 8.
9. Install Torsion Bar Remover and Installer, J-22517-01, Fig. 3-49.

(NOTE: When installing Torsion Bar Remover and Installer, J-22517-01 follow steps 3 and 4 of Part a of this procedure.)

10. Tighten center bolt on Torsion Bar Remover and Installer, J-22517-01 until torsion bar adjusting arm is raised high enough to permit installation of adjuster nut. Install adjuster nut.

BACK TO INDEX

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11. Remove Torsion Bar Remover and Installer, J-22517-01 and install on other end of cross member.
12. Repeat steps 9 and 10 for other torsion bar.
13. Remove Torsion Bar Remover and Installer J-22517-01.
14. Using new torsion bar adjusting bolts, lubricate threads on bolts and install bolts into adjuster nuts on both sides of car.
15. Check standing height, Note 20, and adjust as required.
16. Check front wheel alignment, Note 21, and adjust if necessary.

29. Steering Knuckle and Inner Seal

a. Removal

1. Remove wheel disc.
2. Remove drive axle cotter pin and loosen nut.
3. Loosen wheel mounting nuts.
4. Raise car and place jack stands under lower control arms.
5. Remove drive axle to hub nut and washer and wheel mounting nuts.
6. Remove wheel and tire.
7. Remove upper spherical joint cotter pin and nut.
8. Remove brake line hose clip from upper spherical joint stud, but do not loosen spherical joint stud.
9. Install one or two wheel mounting nuts to prevent disc from falling off hub while removing caliper.
10. Remove two bolts securing caliper to knuckle and slide caliper off knuckle.

CAUTION: Never suspend caliper by brake hose, as the brake hose may become damaged. Use a length of wire to attach caliper to frame.

11. Remove nuts used to retain disc. Mark hub and disc for alignment on assembly and remove disc from hub.
12. Place a short length of rubber hose over the lower control arm torsion bar connector to avoid damage to inboard tri-pot joint seal lip, Fig. 3-51.
13. Position brake hose out of way and, using hammer, strike steering knuckle in area of upper spherical joint and loosen upper spherical joint stud.

CAUTION: Use care to prevent hammer from slipping and damaging brake hose or caliper.

14. Remove cotter pin and nut from tie-rod end.
15. Remove tie-rod end from steering knuckle using Front Suspension Puller, J-24319.
16. Remove cotter pin and nut from lower spherical joint stud.
17. Using Front Suspension Puller, J-24319, disconnect lower spherical joint at steering knuckle.
18. Guide hub and knuckle assembly over end of drive axle and remove from car.

(NOTE: If knuckle is being replaced, remove hub, bearings, cups, and seals as described in Note 34.)

19. To remove steering knuckle inner seal, use a screwdriver, Fig. 3-52.

b. Cleaning and Inspection

Inspect seal surface in the steering knuckle bore and the seal contact surface on the drive axle. Remove any rust present, using #400 grit "wet" paper and kerosene. When sanding, use a circular motion only, to avoid spiral marks on sealing surfaces.

c. Installation

If knuckle is being replaced, install hub, bearings, bearing cups, and seals as described in Note 34 before beginning this procedure.

1. Apply a moderate amount of high melting point lithium base grease between lips of steering knuckle inner seal, Fig. 3-53.
2. Undercut webbing on Seal Installer, J-23115, so that Installer will accept seal.
3. Install seal on Seal Installer, J-23115.
4. Position knuckle and hub assembly on arbor press, Fig. 3-54.

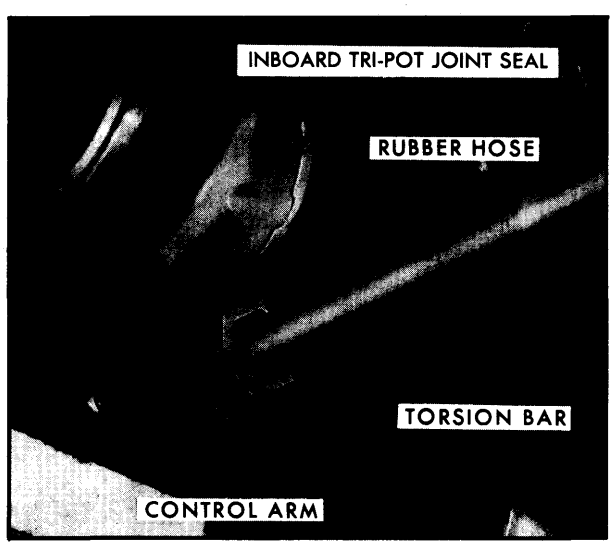


Fig. 3-51 Rubber Hose Location

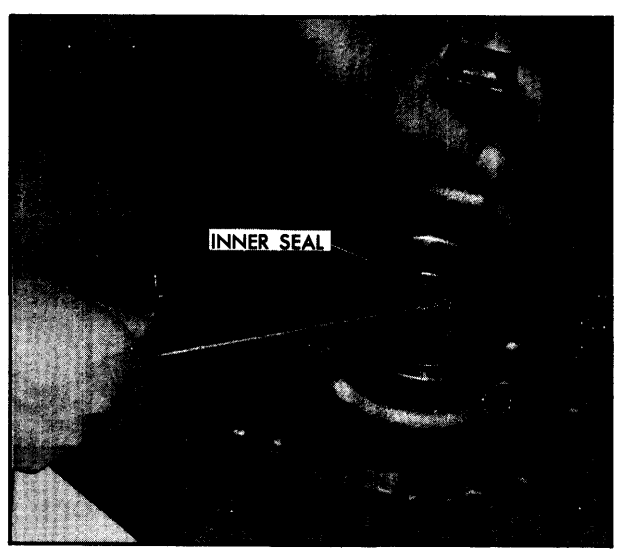


Fig. 3-52 Removing Steering Knuckle Inner Seal

BACK TO INDEX

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Fig. 3-53 Lubricating Steering Knuckle Seal

(NOTE: Support hub and knuckle assembly so that assembly is not supported by the wheel mounting studs.)

5. Position seal and Seal Installer, J-23115, on knuckle and press seal into knuckle, Fig. 3-54.

6. Align splines in hub with splines on drive axle and install hub and knuckle assembly on drive axle.

CAUTION: Use care to avoid damaging the inner seal when installing the knuckle on the drive axle.

7. Install lower spherical joint stud into steering knuckle and attach nut. Do not tighten nut at this time.

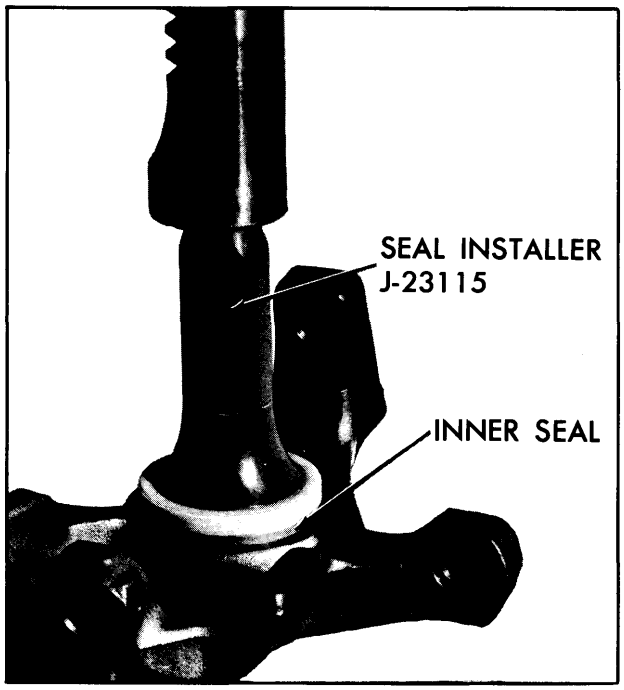


Fig. 3-54 Installing Inner Seal

8. Install tie-rod end stud into knuckle and attach nut. Do not tighten nut at this time.

9. Install upper spherical joint stud into knuckle and install upper spherical joint nut loosely.

10. Using alignment marks placed on hub and disc at time of disassembly, align and install disc on hub.

11. Loosely install two nuts on hub to prevent disc from falling off hub.

12. Install caliper as described in Section 5, Note 12c, Steps 1 through 10, and Step 20.

CAUTION: Do not twist brake hose during installation, as brake system damage may result.

13. Remove upper spherical joint nut to install brake hose clip on stud.

14. Install upper spherical joint nut, tighten nut to 60 foot-pounds, and install new cotter pin. Bend cotter pin tight against flats on nut.

CAUTION: See Page 3-6.

(NOTE: If cotter pin cannot be installed, tighten nut to next hole and install cotter pin.)

CAUTION: Cotter pin must be crimped tight against flat on nut to prevent interference with or damage to the drive-axle constant velocity joint or seal.

15. Tighten tie-rod end nut to 40 foot-pounds and install new cotter pin.

CAUTION: See Page 3-6.

16. Tighten nut on lower spherical joint stud to 80 foot-pounds and install new cotter pin.

CAUTION: See Page 3-6.

(NOTE: If cotter pin cannot be installed, tighten nut to next hole.)

17. Remove rubber hose from lower control arm torsion bar connector, Fig. 3-51.

18. Install drive axle washer and nut. Do not tighten nut at this time.

19. Install wheel and tire.

20. Install wheel mounting nuts; turn up snug, but do not tighten nuts at this time.

21. Raise car, remove jack stands, and lower car.

22. Tighten wheel mounting nuts to 130 foot-pounds.

CAUTION: See Page 3-6.

23. Tighten drive axle to hub nut. After reaching 110 foot-pounds minimum, nut must always be tightened further, never backed off, to install cotter pin. Install new cotter pin.

CAUTION: See Page Page 3-6.

(NOTE: If cotter pin cannot be installed, tighten nut to next hole.)

24. Install wheel disc.

25. Check standing height and front end alignment and adjust as required.

26. With vehicle weight supported by front wheels, inspect front brake hose to be sure it is not twisted.

BACK TO INDEX

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30. Lower Control Arm Spherical Joint Seal

The lower spherical joint seal can be installed with the lower control arm either on or off the car.

a. Removal (On Car)

1. Remove steering knuckle as described in Note 29a.
2. Using a hammer, tap lightly on seal retainer.
3. Use a small screwdriver to work retainer off joint. Discard seal and retainer.
4. Wipe grease from spherical joint and stud.

b. Installation

1. Position new seal over spherical joint stud.
2. Lubricate jaws of Camber Adjusting Wrench, J-9231, and slide jaw between seal and retainer.
3. Tap lightly with hammer on end of Camber Adjusting Wrench, J-9231, until seal retainer is fully seated.
4. Install steering knuckle as described in Note 29c.
5. Lubricate joint using special lubricant recommended for this application until lubricant escapes from valve inside of seal, Fig. 3-55.

31. Lower Control Arm

The lower control arm components are serviced as individual parts.

a. Removal

1. Remove wheel disc.
2. Loosen wheel mounting nuts.
3. Remove hub cotter pin and loosen nut.
4. Raise car.
5. Remove wheel and tire.

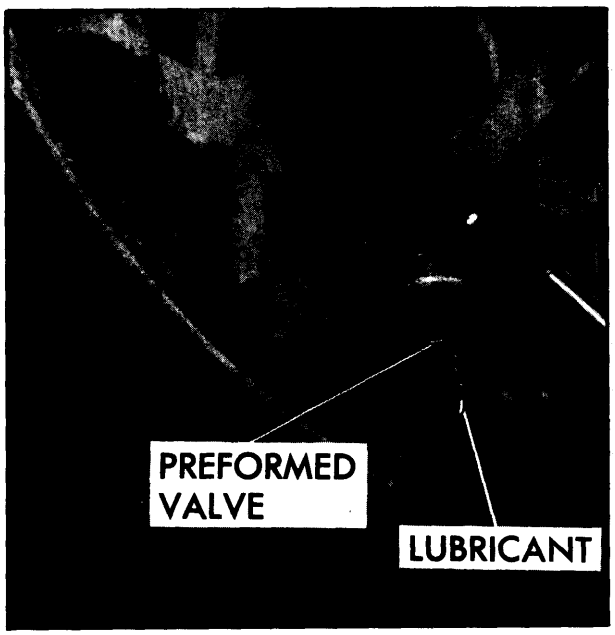


Fig. 3-55 Repacking Lower Spherical Joint

6. Remove torsion bar as described in Note 29a.
7. Remove hub nut and washer.
8. Remove brake hose clip(s) attached to frame.

(NOTE: Right side of car has two frame attaching clips.)

9. Remove cotter pin, nut, and brake hose clip from upper spherical joint stud.
10. Using a hammer, strike knuckle in area of upper spherical joint and remove joint from steering knuckle.

CAUTION: Use care to prevent hammer from slipping and damaging brake hose.

11. Disconnect shock absorber at lower mount, then work shock off mount using a screwdriver to pry bushing off stud.
12. Using Front Suspension Puller, J-24319, disconnect tie rod end at steering knuckle.
13. Disconnect stabilizer bar and disconnect nut and link bolt.
14. Using Front Suspension Puller, J-24319, disconnect lower spherical joint.
15. Disengage hub, knuckle, and disc as an assembly from drive axle and secure assembly to upper control arm with a piece of wire.

CAUTION: Take care to avoid damaging brake hose.

16. Remove lower control arm to frame attaching nuts and bolts.
17. Disengage lower control arm from frame mounts and remove control arm.

b. Installation

1. Remove wire and install hub, disc, and knuckle assembly on drive axle.
2. Install lower control arm into mounts in chassis. Do not tighten nuts at this time.
3. Install lower control arm spherical joint into steering knuckle. Tighten nut to 80 foot-pounds and install new cotter pin. (If pin cannot be installed, tighten nut to next hole and install cotter pin.)

CAUTION: See Page 3-6.

4. Tighten lower control arm inner mount bolts to 80 foot-pounds.

CAUTION: See Page 3-6.

5. Lift up upper control arm and install shock absorber on lower control arm mount. Tighten nut to 75 foot-pounds.
6. Install upper control arm spherical joint into steering knuckle.
7. Install brake hose clip on upper spherical joint stud. Tighten nut to 60 foot-pounds and install new cotter pin.

CAUTION: See Page 3-6.

(NOTE: If pin cannot be installed, tighten nut to next hole. Cotter pin must be crimped tight against flats on nut to prevent cotter pin from interfering with outer constant velocity joint seal.)

BACK TO INDEX

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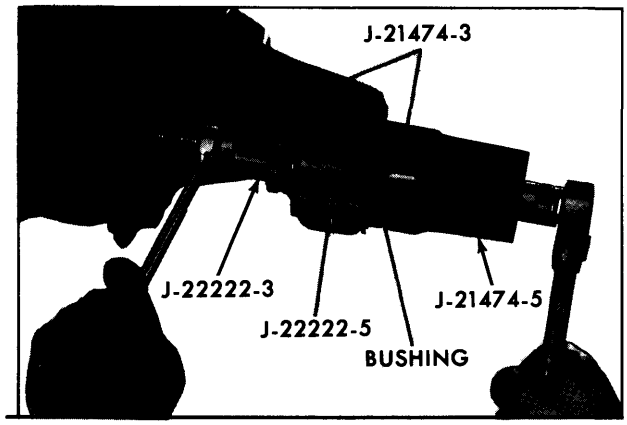


Fig. 3-56 Removing Control Arm Bushings

8. Install brake hose clip(s) to frame. (Right side of car has two frame attaching clips.)
9. Install tie rod end in steering knuckle. Tighten nut to 40 foot-pounds, and install new cotter pin.

CAUTION: See Page 3-6.

(NOTE: If pin cannot be installed, tighten nut to next hole.)

10. Install stabilizer bar on control arm as described in Note 23b.
11. Install washer and nut securing hub to drive axle.
12. Install torsion bar as described in Note 29b.
13. Install wheel and tire.
14. Lower car and examine brake lines to be sure they are not twisted.
15. Tighten drive axle nut. After reaching 110 foot-pounds minimum, nut must always be tightened further, never backed off, to install cotter pin. Install new cotter pin.

CAUTION: See Page 3-6.

(NOTE: , If cotter pin cannot be installed, tighten nut to next hole location and install cotter pin.)

16. Tighten wheel nuts to 130 foot-pounds.

CAUTION: See Page 3-6.

17. Adjust standing height and front wheel alignment as described in Notes 20 and 21.
18. Install wheel disc.

32. Lower Control Arm Bushings

a. Removal

1. Remove lower control arm as described in Note 31a.

(NOTE: Spray bushings with silicone lubricant to facilitate removal.)

2. Install tools as shown in Fig. 3-56 and press bushings out of control arm.

b. Installation

(NOTE: Dual rate bushings, which must be oriented in the arm at installation, are used in the lower control arms.)

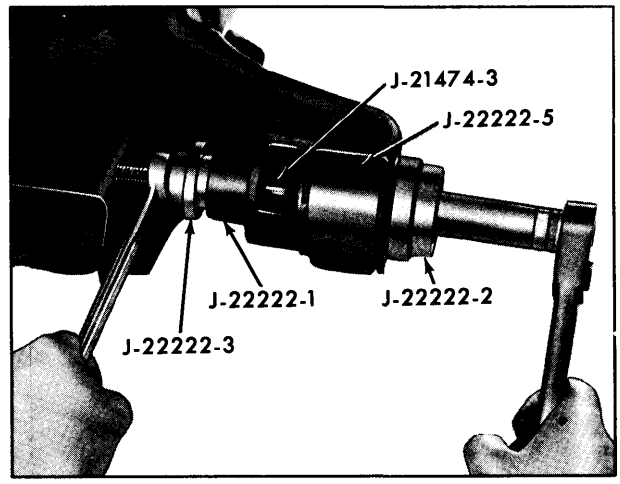


Fig. 3-57 Installing Control Arm Bushings

1. Invert the arm on a flat table surface. A 9/16" height difference must be obtained between the spherical joint end of the arm, Fig. 3-39 and the flat table surface.
2. Position the bushings so the centerline of the notches in the bushings are parallel with the flat table surface on which the arm rests, Fig. 3-39.

(NOTE: Spray bushings with silicone lubricant to facilitate installation.)

3. Install tools as shown in Fig. 3-57, and press bushings into lower control arm.
4. Install lower control arm as described in Note 31b.

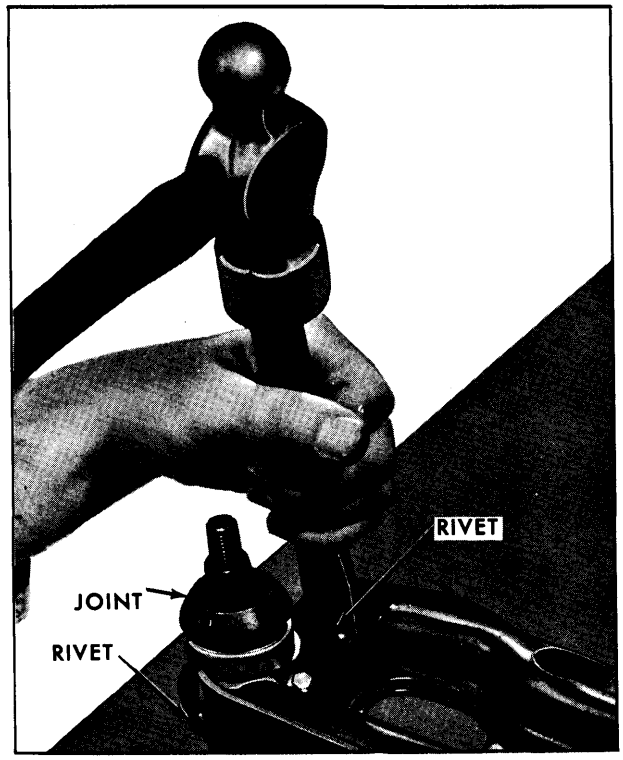


Fig. 3-58 Removing Lower Spherical Joint

BACK TO INDEX

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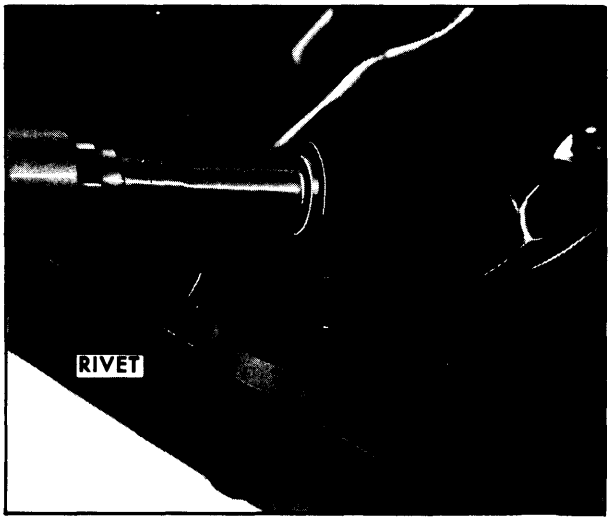


Fig. 3-59 Grinding Spherical Joint Rivet

5. Check standing height and front wheel alignment and adjust as necessary, Notes 20 and 21.

33. Lower Control Arm Spherical Joint

a. Removal

1. Remove lower control arm as described in Note 31a.
2. Place lower control arm on bench with spherical joint stud up.
3. Using a chisel, cut two rivet heads off as shown in Fig. 3-58.
4. Place lower control arm right side up and grind large rivet head off as shown in Fig. 3-59.
5. Using a hammer and punch, drive on center rivet of joint until joint is out of control arm.

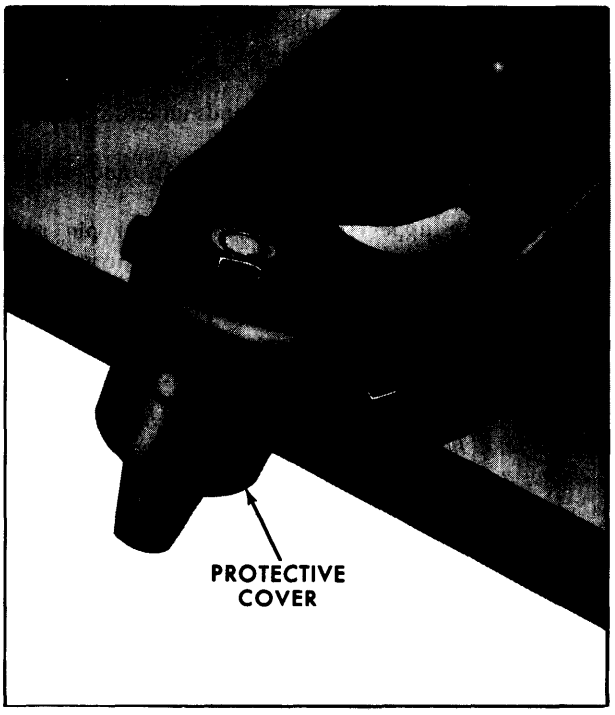


Fig. 3-60 Lower Spherical Joint Installed

b. Installation

1. Install service spherical joint into control arm as shown in Fig. 3-60 and tighten bolts and nut.
2. Install lower control arm as described in Note 31b.

34. Hub Bearing, and Knuckle Assembly (Fig. 3-61)

a. Removal

1. Remove wheel disc.

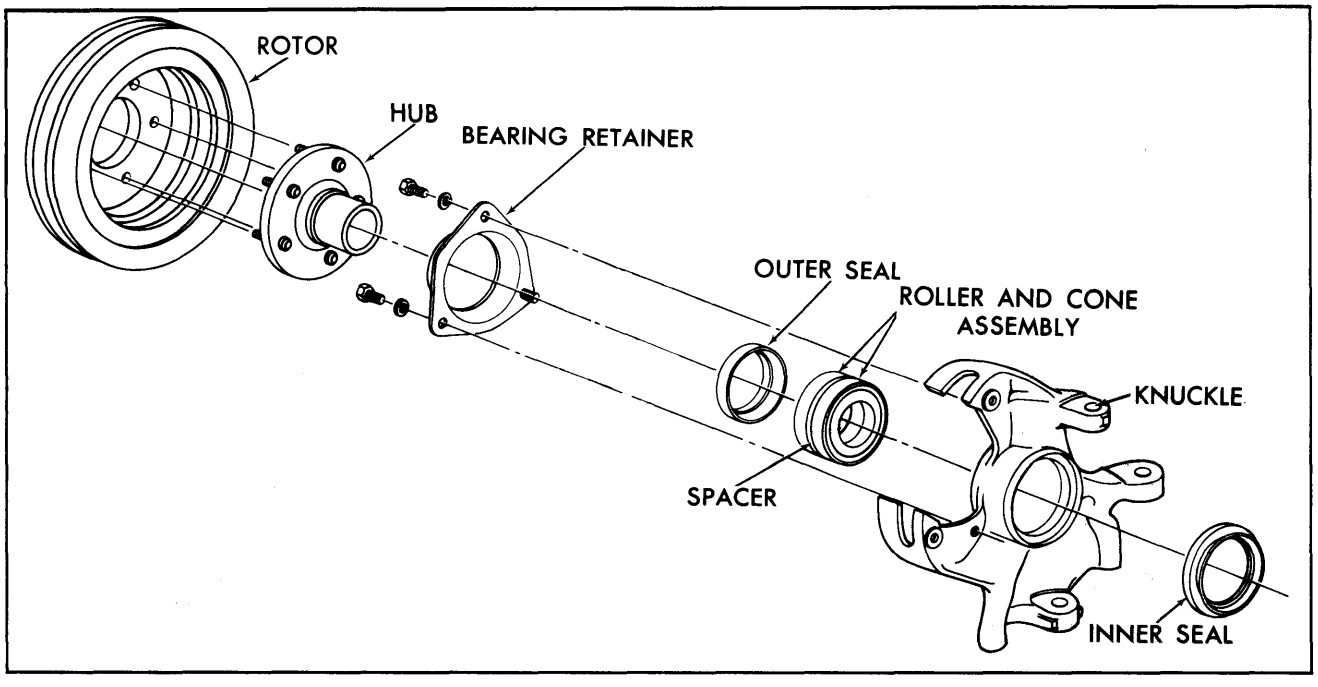


Fig. 3-61 Front Hub, Bearing and Knuckle Disassembled

BACK TO INDEX

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2. Loosen wheel mounting nuts.
3. Remove drive axle cotter pin.
4. Loosen drive axle nut.
5. Raise car and place jack stands under lower control arms.
6. Remove drive axle nut, washer, and wheel mounting nuts, and remove wheel and tire.
7. Remove upper spherical joint cotter pin and loosen nut. Remove nut and brake hose clip from stud, then re-install nut.
8. Remove two bolts securing caliper to knuckle and slide caliper off disc.
9. Position brake hose and caliper out of way.

CAUTION: Do not allow caliper to hang from the brake hose, as the brake hose may become damaged.

10. Mark hub and disc for alignment on assembly and remove disc.
11. Strike steering knuckle in area of upper spherical joint until upper spherical joint is loose.

CAUTION: Use extreme care to prevent hammer from slipping and damaging brake hose.

12. Install a short length of rubber hose over the lower control arm torsion bar connector to avoid damage to inboard tri-pot joint seal when hub and knuckle are removed, Fig. 3-51.
13. Remove tie rod end cotter pin and nut.
14. Using Front Suspension Puller, J-24319, disconnect tie rod end at steering knuckle.
15. Remove lower spherical joint cotter pin and nut.
16. Using Front Suspension Puller, J-24319, disconnect lower spherical joint.
17. Remove upper spherical joint nut.
18. Remove upper spherical joint stud from steering knuckle.

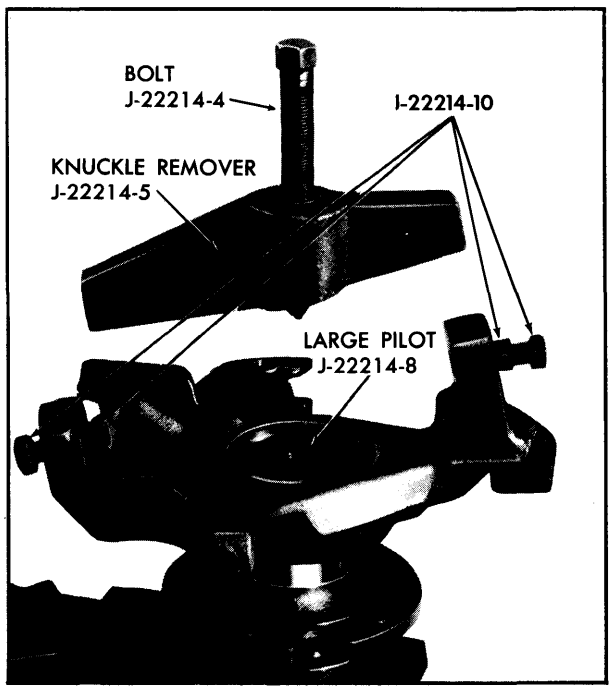


Fig. 3-62 Hub and Bearing Removal Tools

19. Remove hub and knuckle as an assembly.

b. Disassembly

1. Remove three screws and washers securing spacer and bearing retainer to steering knuckle and remove spacer.
2. Remove steering knuckle inner seal, Fig. 3-52 and discard seal.

CAUTION: Use care when removing seal to prevent damage to the seal mating surface on the steering knuckle.

3. Install Small Bushing, part of set J-22214-10, in upper end of steering knuckle, Fig. 3-62.
4. Install Large Bushing, part of set J-22214-10, in lower end of steering knuckle, Fig. 3-62.
5. Install Large Pilot, J-22214-8, on inner end of hub, Fig. 3-62.
6. Install Knuckle Remover, J-22214-5, between upper and lower ends of steering knuckle, Fig. 3-62.
7. Secure Knuckle Remover to steering knuckle by installing two Small Bolts, J-22214, through bushings previously installed.
8. Secure Knuckle Remover, J-22214-5, in a vise, with knuckle assembly attached, Fig. 3-63.
9. Coat Large Bolt, J-22214-4, with chassis lubricant and install bolt in Knuckle Remover, J-22214-5.
10. Tighten Large Bolt, J-22214-4, until hub, bearing, retainer, spacer, steering knuckle outer seal, and bearing assembly are pressed out of steering knuckle.
11. Remove spacer.
12. Pry outer seal away from bearing package, Fig. 3-64.

(NOTE: A simple tool such as the one described in Fig. 3-33 is ideal for this prying operation. This can be made from an old screwdriver or a piece of cold rolled steel.)

13. Use a hammer and a 3/8" chisel to cut through outer seal. Then remove seal from bearings, Fig. 3-64.

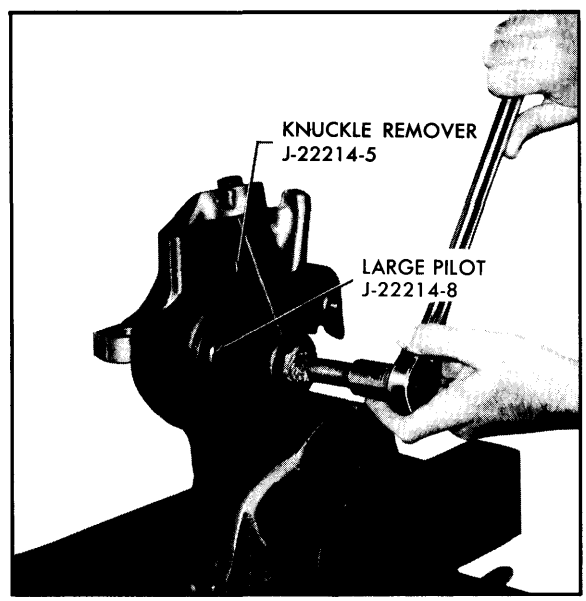


Fig. 3-63 Removing Hub and Bearing

BACK TO INDEX

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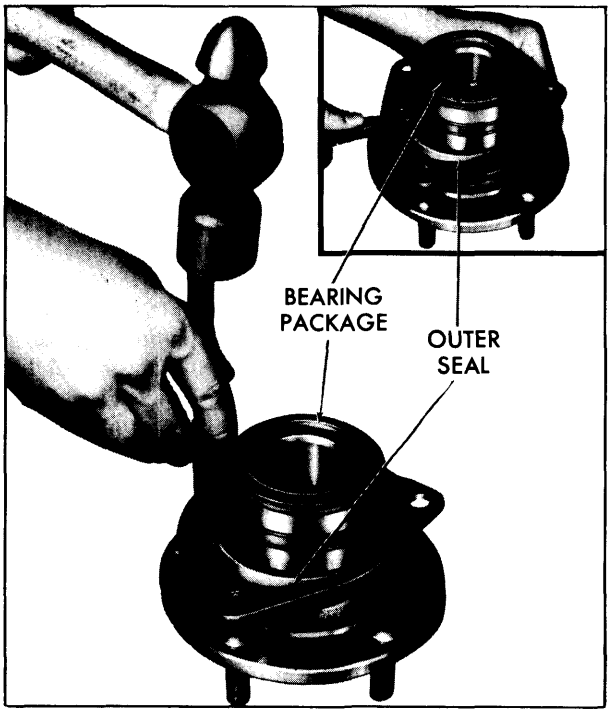


Fig. 3-64 Removing Outer Seal

CAUTION: When chiseling, hold hammer and chisel in a strictly vertical position to avoid damaging hub.

14. Place assembly in arbor press so that hole in Press Plate, J-23997, lines up with hole in anvil. Press bearings from hub, Fig. 3-65.

c. Assembly

The front wheel bearings are supplied as matched assemblies and must be serviced as complete assemblies.

Inspect the steering knuckle bore and the steering knuckle seal contact surface on the drive axle. Remove any rust present using #400 grit "wet" paper and kerosene. When sanding, use a circular motion only to avoid spiral marks on sealing surface.

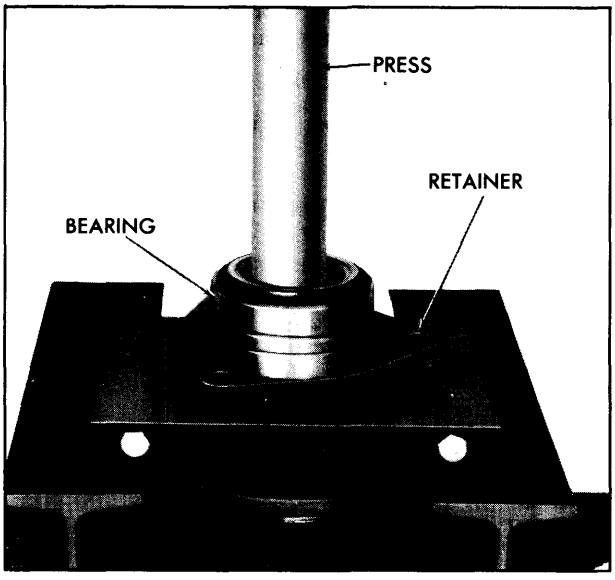


Fig. 3-65 Removing Bearings

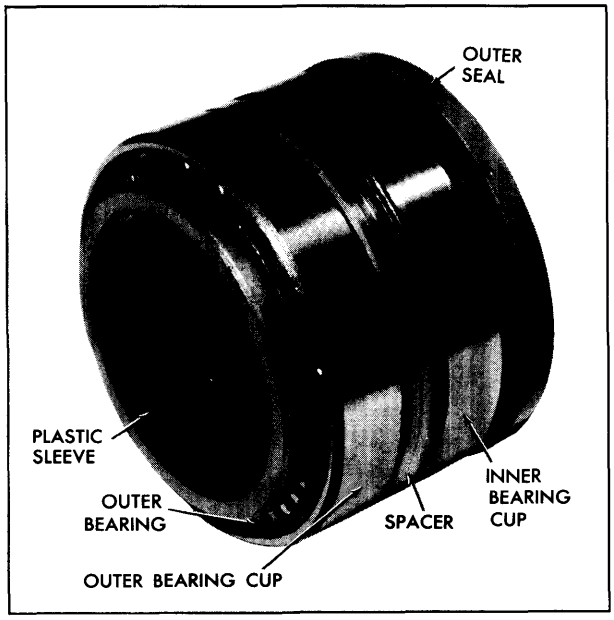


Fig. 3-66 Bearing Package

1. Position steering knuckle on arbor press with outboard face of knuckle facing up.

2. Using special lubricant provided in bearing package, apply lubricant to hub shaft and between lips of both steering knuckle seals, Fig. 3-53.

(NOTE: One tube of lubricant will service one complete hub and knuckle assembly.)

3. Install outer steering knuckle seal on Seal Installer, J-23114.

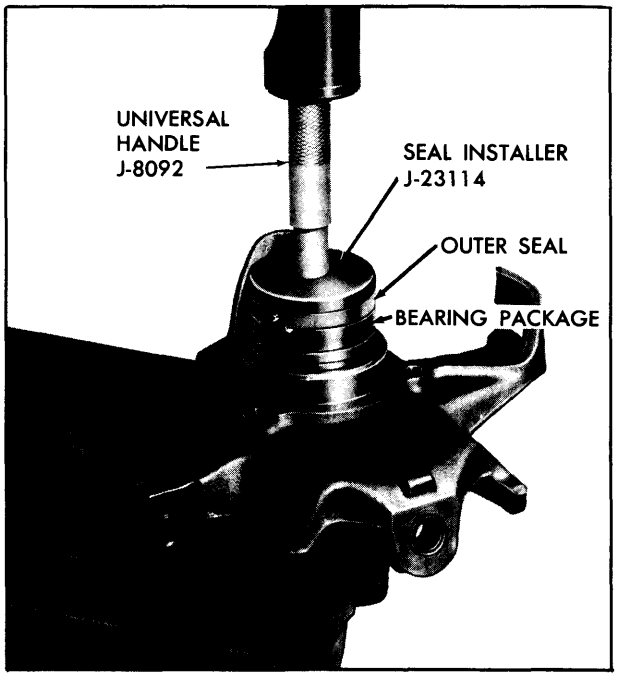


Fig. 3-67 Installing Bearing Package

BACK TO INDEX

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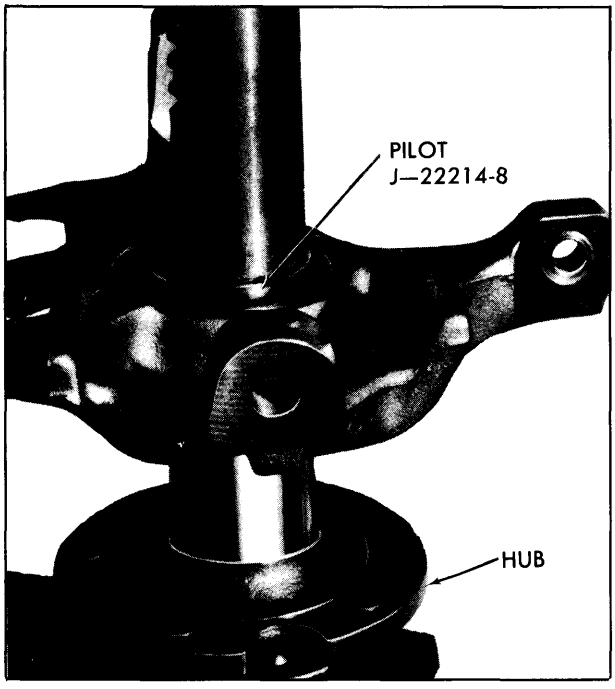


Fig. 3-68 Installing Hub in Knuckle

4. Position seal and seal installer on bearing package and position package in steering knuckle bore.

CAUTION: Do not remove disposable sleeve in bearing package at this time, as sleeve is used as a retainer to prevent bearings from being mispositioned in cups, or damaged during installation, Fig. 3-66.

5. Press bearing package and outer seal into steering knuckle, Fig. 3-67. Bearing package and outer seal are installed when inner bearing cup bottoms out on shoulder in steering knuckle bore.

6. Position spacer on outer face of steering knuckle.

7. Position bearing retainer over spacer and secure bearing retainer and spacer to steering knuckle with three screws and washers. Tighten screws to 30 foot-pounds. Remove knuckle assembly from press.

8. Remove disposable sleeve from bearing package previously installed in steering knuckle.

9. Working from inner face of steering knuckle, use remainder of special lubricant to coat inner race of bearings before installing hub in knuckle and bearing assembly.

10. Position hub on arbor press with stud end down.

CAUTION: To avoid damaging the mounting studs, support hub so that hub is not supported by the wheel mounting studs.

11. Position knuckle and bearing assembly on hub.

12. Install Large Pilot, J-22214-8, through steering knuckle so that pilot seats on bearing, Fig. 3-68, and press knuckle assembly on hub.

13. Install inner seal on Seal Installer, J-23115, and press inner seal into steering knuckle, Fig. 3-52.

(NOTE: Webbing of Seal Installer, J-23115, may have to be undercut before tool will accept seal.)

d. Installation

1. Guide knuckle assembly over drive axle, install lower spherical joint stud into knuckle, and attach nut. Do not tighten nut at this time.

CAUTION: Use care to avoid damaging inner seal when guiding the knuckle over the drive axle.

2. Install tie-rod end stud into knuckle and attach nut. Do not tighten nut at this time.

3. Install upper spherical joint stud into knuckle and install upper spherical joint stud nut loosely.

4. Using alignment marks placed on hub and disc at time of disassembly, align disc with hub and install disc on hub.

5. Install one or two nuts on hub to prevent disc from falling or being knocked off hub.

6. Install caliper as described in Section 5, Note 12c, Steps 1 through 10 and Step 20.

(NOTE: Remove upper spherical joint nut to install brake hose clip on stud. Take care not to twist brake hose during caliper installation.)

7. Install upper spherical joint nut, tighten nut to 60 foot-pounds and install new cotter pin. Bend cotter pin tight against flats on nut.

CAUTION: See Page 3-6.

(NOTE: If cotter pin cannot be installed, tighten nut to next hole and install cotter pin. Cotter pin must be crimped tight against flats on nut to prevent interference with or damage to the drive axle constant velocity joint or seal.)

8. Tighten tie-rod end nut to 40 foot-pounds and install new cotter pin.

CAUTION: See Page 3-6.

(NOTE: If pin cannot be installed, tighten nut to next hole.)

9. Tighten nut on lower spherical joint stud to 80 foot-pounds and install cotter pin.

CAUTION: See Page 3-6.

(NOTE: If pin cannot be installed, tighten nut to next hole.)

10. Remove rubber hose from lower control arm torsion bar connector.

11. Install drive axle washer and nut. Do not tighten nut at this time.

12. Remove nuts used to hold disc on hub, and install wheel and tire.

13. Install wheel mounting nuts; turn up snug, but do not tighten nuts at this time.

14. Raise car, remove jack stands, and lower car.

15. Inspect front brake hose to make sure it is not twisted.

16. Tighten wheel mounting nuts to 130 foot-pounds.

CAUTION: See Page 3-6.

BACK TO INDEX

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17. Tighten drive axle nut. After reaching 110 foot-pounds minimum, nut must always be tightened further, never backed off, to install cotter pin. Install new cotter pin.

CAUTION: See Page 3-6.

(NOTE: If pin cannot be installed, tighten nut to next hole.)

18. Check standing height and front end alignment and adjust as required, Notes 20 and 21.
19. Install wheel disc.

35. Front Wheel Stud Replacement (E-Car)

a. Removal

1. Raise car and remove front wheel.
2. Remove two bolts which hold caliper to steering knuckle.

(NOTE: It is not necessary to remove brake hose from caliper when removing disc for service.)

3. Remove cotter pin, loosen joint upper ball nut and slip brake hose collar out of its clip. The slack gained will permit removal of caliper without pulling hose.
4. Slide caliper off disc and support by a hook-shaped wire fastened to upper control arm.

CAUTION: Do not allow caliper to hang from brake hose as this could result in possible damage to hose.

5. Mark a wheel stud and a corresponding place on the disc to assist in installation.
6. Remove the disc by sliding it off the hub.
7. Install tool J-5504 on damaged stud and press stud from hub, Fig. 3-69.

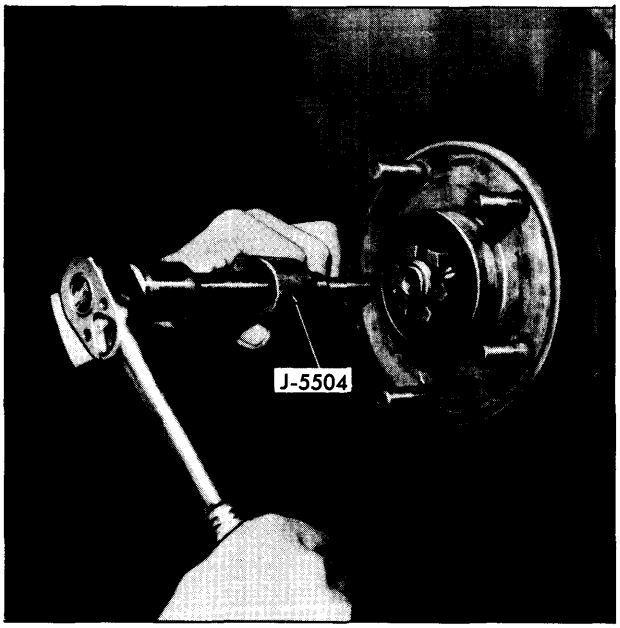


Fig. 3-69 Removing Wheel Stud

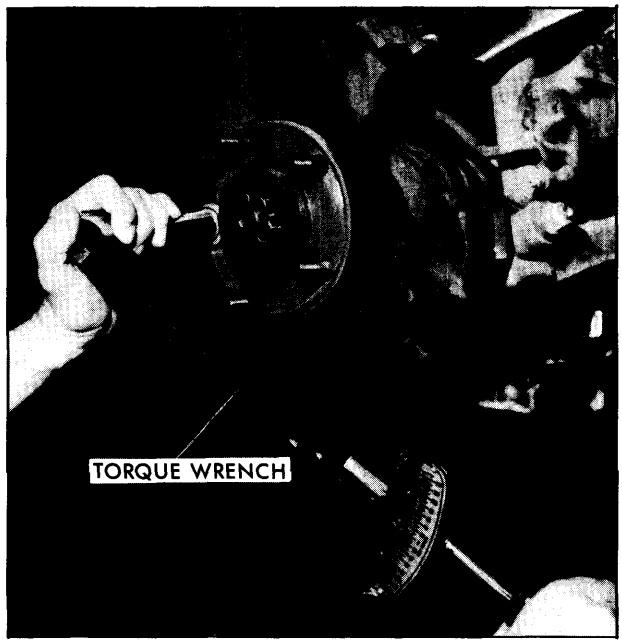


Fig. 3-70 Installing Wheel Stud

(NOTE: Optional tool J-22292-1 may be used for this application. Either tool must be modified by cutting 1/4" off the end of each leg.)

b. Installation

1. Install a new stud from back side of hub.
2. Install two flat washers on stud and wheel nut, flat side toward washers, and tighten nut with fingers.
3. Torque nut to 140 foot-pounds, Fig. 3-70.
4. Remove nut and washers from stud and discard.
5. Visually inspect stud threads and stud head for being properly seated on hub flange.
6. Inspect hub flange and disc mating surfaces to make sure that they are free of dirt and other foreign material. Clean as required.
7. If reinstalling original disc, align index marks on hub and disc and slide disc over hub pilot diameter, making sure that disc is seated against hub flange.

(NOTE: If disc replacement is necessary, the new disc may be assembled to the hub in any position. It is not necessary to replace both discs if one is all right.)

8. Position caliper on disc and line up holes in caliper ears with holes in steering knuckle. Make sure brake hose is not twisted, as its natural curvature is essential to maintain proper hose-to-suspension clearance through full movement of suspension and steering parts.
9. Wipe all dirt and corrosion from the caliper mounting bolts. Do not use abrasives, as they will remove protective plating. Lubricate smaller ends of bolts with silicone lubricant.
10. Start either bolt into the inboard ear of the caliper and into the steering knuckle. At this point it is necessary to be sure that the bolt passes under the retaining ear on the inboard shoe to maintain the shoe in position in the caliper.
11. Pass the bolt on through the outboard ear on the

BACK TO INDEX

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caliper until the threads on the bolt can be started into the steering knuckle.

12. Repeat steps 10 and 11 in placing remaining bolt into caliper assembly.

See CAUTION when performing steps 13, 17 and 18.

CAUTION: See page 3-6.

13. Tighten caliper mounting bolts to 30 foot-pounds.

14. Pump brake pedal to seat lining against rotors.

15. Clinch upper ears of outboard shoe by positioning 12" pliers with one jaw on top of upper ear and one jaw in notch on bottom of shoe, opposite upper ear.

(NOTE: After clinching, there should be no radial clearance between the shoe ears and caliper housing.)

16. If radial clearance exists, repeat clinching procedure.

17. Center brake hose collar in clip and tighten ball joint nut to 60 foot-pounds. Install cotter pin.

18. Install wheels, tighten wheel mounting nuts to 130 foot-pounds and lower car.

19. Allow car weight to be supported on front wheels and inspect from brake hoses for twisted condition. Correct if necessary.

20. Before moving the vehicle, pump the brake pedal two or three times to insure firm pedal.

21. Drive car around several blocks making left hand and right hand turns.

22. Re-torque wheel mounting nuts to 130 foot-pounds.

23. Install wheel disc.

BACK TO INDEX

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GENERAL DESCRIPTION

(NOTE: The following information is applicable only to the Eldorado.)

The front wheel drive system consists of a final drive unit, right and left output shafts, and right and left drive axles.

The final drive assembly includes a spiral bevel ring and pinion gear set with a ratio of 2.73:1 and a spur bevel differential gear set. The function of the unit is similar to that of a standard differential. The pinion gear is splined directly to the transmission, and the housing is secured to the transmission by eight fasteners: six screws, and two nuts that attach to studs in the transmission. The final drive housing is secured at its forward end by a support bracket which in turn is fastened to an engine mount bracket.

A twin gasket assembly is used between the final drive housing and cover to provide a controlled vent for excess lubricant.

Torque from the final drive is transmitted to the output shafts which connect to the drive axles. The output shafts are splined to the side gears in the final drive. The longer right output shaft requires a special support brace.

The drive axles, Fig. 3-71, are flexible assemblies, consisting of an axle shaft with a ball-type constant velocity joint at the outboard end and a tri-pot constant velocity joint at the inboard end. Tri-pot joints flex not only in respect to the angle through which they operate, but also in and out. This provides a means of lengthening and shortening of the drive axles as required by the front suspension as it travels through its ride motion.

The right drive axle incorporates a torsional damper.

DIAGNOSIS

CONDITION	CAUSE	CORRECTION
Clicking noise in turns.	Excessive wear or broken outboard joint.	Inspect and replace outboard joint if necessary.
Coast to drive "clunk".	Drive Axle to Output Shaft Screws.	Tighten to specified torque.
	Idle speed too high.	Adjust to specification.
	Inoperative rubber damper (RH side).	Replace right shaft and damper assembly.
	Loose spline RH damper to shaft.	Replace right shaft and damper assembly.
Shudder or vibration on acceleration.	Incorrect U-joint angle.	Check front standing height and correct if necessary.
	Excessive wear on inboard joint housing.	Check for brinelling of housing bores and replace if necessary.
	Worn spider assembly.	Check for wear or free rotation of balls on spider. Replace spider assembly if necessary.
Shimmy vibration at highway speeds.	Tires out of balance or out of round.	Balance front wheels. Replace if out of round.

SERVICE INFORMATION

The final drive unit is not serviced but is replaced as an assembly, with the exception of the following parts, which are serviced separately: pinion oil seal, output shaft seal, pinion bearing housing O-ring, vent pin, seal cover gasket, and filler plug gasket.

The drive axle outer constant velocity joints can be disassembled for repacking and replacement of seals. If any other defect is found, replace the joint as an assembly. The inboard tri-pot joints can be disassembled for repacking and replacement of the spider components, seals, and housing end cover O-ring.

CAUTION: Whenever any operations call for disconnection, connection, removal, or installation of the drive axles, extreme care must be exercised to prevent damage to the seals. When performing these operations, install a short length of rubber hose on the lower control arm torsion bar connector to prevent inboard tri-pot joint seals from being damaged.

CAUTION: When removing or installing the right drive axle, be sure to disconnect the negative battery cable. It is possible to short out the starter motor by making contact between the wrench and the starter motor terminals.

CAUTION: If any mispositioning, incorrect assembly, or failure of components in the area of the brake system pipes, hoses, or cylinders is observed, be sure to check for any brake damage that

BACK TO INDEX

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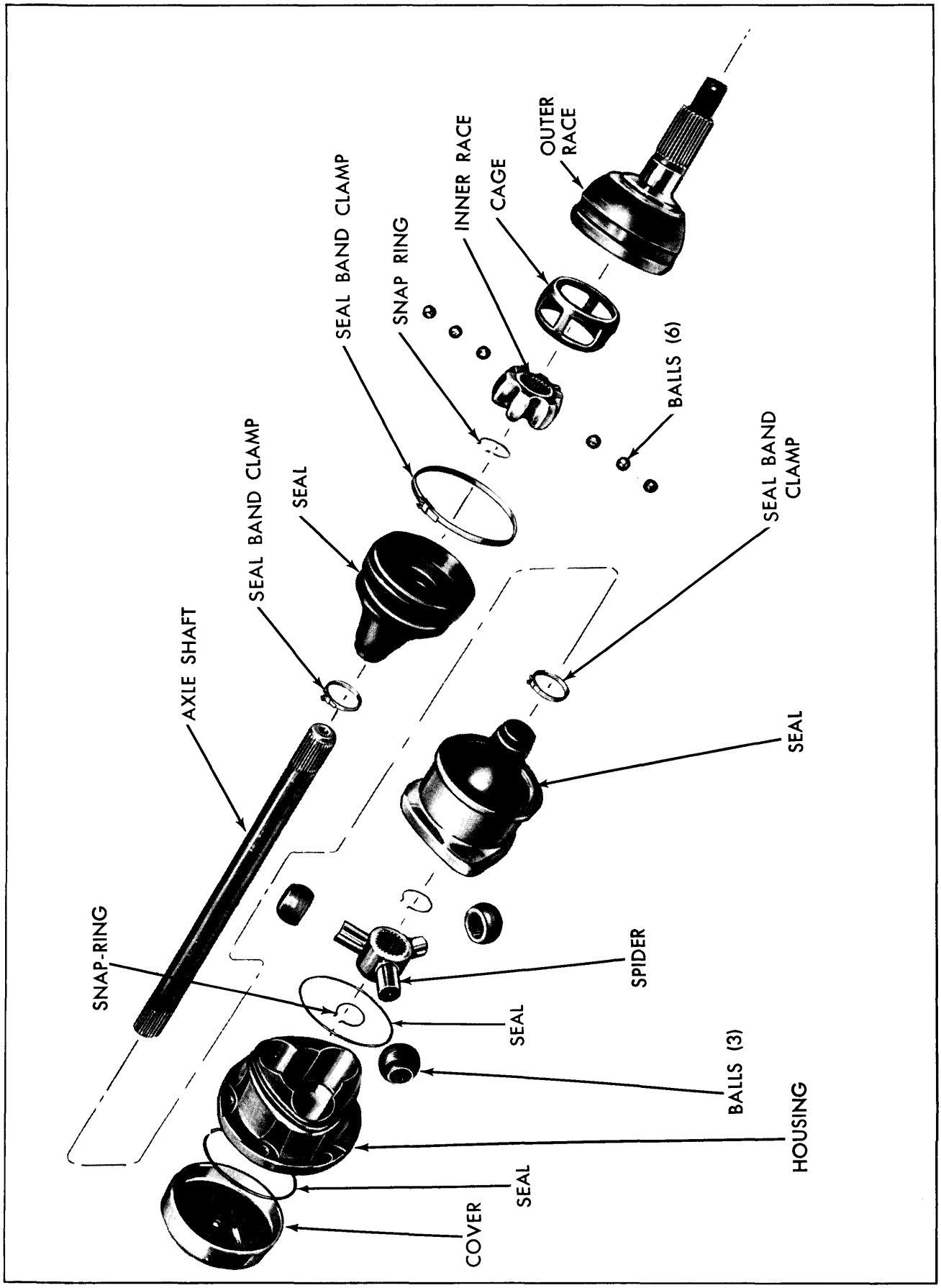


Fig. 3-71 Drive Axle Disassembled

BACK TO INDEX

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may have resulted from such a condition and correct as required. Components that could damage the brake system due to mispositioning, incorrect assembly, or failure include the exhaust system, shock absorbers, torsion bars, suspension control arms, stabilizer bar, power steering pump hoses, and transmission cooler pipes.

36. Right Output Shaft and Drive Axle

a. Removal

1. Disconnect negative battery cable.
2. Remove wheel disc.

(NOTE: If drive axle is to be removed, remove cotter pin and loosen but do not remove spindle nut.)

3. Raise car so that front vehicle weight is supported at lower control arms.
4. Loosen but do not remove right front shock absorber lower mounting nut and, using a screwdriver on the mount inner sleeve, pry shock absorber along lower mounting stud until it reaches nut.

CAUTION: Do not remove shock absorber from lower mount, because this may allow the lower control arm to drop.

5. Install a short length of rubber hose on both lower control arm torsion bar connectors, Fig. 3-51.
6. Remove six screws and lockwashers securing right drive axle to output shaft.
7. Move inboard end of drive axle rearward toward starter motor to gain access to output shaft.
8. Remove screw securing output shaft support strut to final drive housing, Fig. 3-72.
9. Remove two screws and flat washers securing right output shaft support to engine, Fig. 3-72.
10. Remove right output shaft, support, and strut as an assembly as follows: first, slide output shaft outboard to disengage splines; then move inboard end of assembly forward and downward until clear of car.

CAUTION: Take care to protect output shaft seal surface and splines from nicks or scratches.

11. If drive axle is to be removed, perform the following:

a. Using a block of wood and a hammer, strike end of drive axle to unseat axle at hub.

(NOTE: Spindle nut should be left on to retain axle but loose enough to allow unseating.)

b. Rotate axle inboard and toward front of car, guiding axle over front cross member and out from underside of car.

b. Installation

(NOTE: If drive axle was not removed, begin with Step 3.)

1. Guide drive axle into position from underside of car.

(NOTE: Guide axle up and over front cross member and engage drive axle splined end in knuckle and hub.)

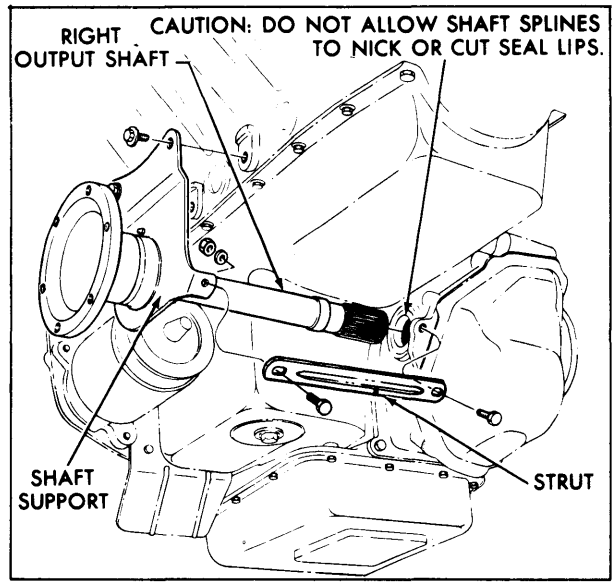


Fig. 3-72 Right Output Shaft

2. Rotate inner end of the drive axle rearward toward starter motor.
3. Apply clean front wheel bearing grease between lips of output shaft seal, then install output shaft into final drive unit from underside of car, indexing splines of output shaft with final drive.
4. Install two bolts and washers securing output shaft support to engine. Tighten bolts to 50 foot-pounds.

(NOTE: Seat washers in old grooves in output shaft support. If a new output shaft support is being installed, perform the following procedure: when attaching the right hand output shaft support to the engine block, do not let the shaft and support assembly hang in the final drive unit. Install support bolts and washers loosely, and by moving the flange end of the shaft up and down and back and forth, find the center location. Hold the shaft in this position and then tighten bolts to 50 foot-pounds.)

5. Install self-tapping screw securing output shaft support strut to final drive housing.
6. Rotate drive axle toward front of car and into position.
7. Install six new screws and lockwashers securing drive axle to output shaft. Tighten screws to 65 foot-pounds. Have a helper apply the brakes to prevent the drive axle from turning when installing screws.
8. Install drive axle spindle nut. Do not tighten nut at this time.
9. Lower car.
10. Tighten drive axle spindle nut. After reaching 110 foot-pounds minimum, nut must always be tightened further, never backed off, to install cotter pin. If cotter pin cannot be installed, tighten nut to next hole.

CAUTION: See Page 3-6.

11. Connect negative battery cable.
12. Check final drive oil level and check for oil leaks at output shaft.

BACK TO INDEX

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37. Left Output Shaft and Drive Axle

a. Removal

1. Remove wheel disc.
2. Loosen wheel mounting nuts.
3. Remove drive axle spindle nut cotter pin and loosen nut.
4. Raise car.
5. Remove wheel mounting nuts and drive axle spindle nut.
6. Remove wheel and tire.
7. Remove six drive axle to output shaft screws and lockwashers and discard screws and washers. Have a helper apply the brakes to prevent drive axle from rotating when removing screws.
8. Loosen shock absorber upper mount bolt.
9. Remove upper spherical joint cotter pin and nut, and remove brake hose clip from joint stud.
10. Using a hammer, strike knuckle in area of upper spherical joint. Lift up on upper arm and remove joint stud from steering knuckle.

CAUTION: Use extreme care to prevent hammer from slipping and damaging brake hose.

11. Remove brake hose bracket from frame.
12. Carefully tip disc and knuckle assembly out at upper end to extent of brake hose.

CAUTION: To prevent damaging the brake hose, wire assembly to upper control arm so that brake hose does not support the weight of the knuckle assembly.

13. Rotate inner end of drive axle toward front of car.
14. Guide drive axle out of knuckle and remove drive axle from car.
15. Remove left output shaft retaining bolt.

(NOTE: To remove bolt, install two screws in output shaft flange to prevent output shaft from rotating.)

16. Remove output shaft by pulling straight out toward side of car.

CAUTION: Use extreme care when removing output shaft to protect oil seal surface on shaft from nicks and scratches.

b. Installation

1. Apply clean wheel bearing grease between lips of final drive output shaft seal.
2. Install output shaft from underside of car.

CAUTION: Use extreme care when indexing output shaft splines with splines in final drive unit to prevent damage to the splines.

3. Install output shaft retaining bolt. Tighten bolt to 40 foot-pounds.

(NOTE: To install bolt, install two screws in output shaft flange to prevent output shaft from rotating.)

4. Guide drive axle into car and install drive axle spindle into steering knuckle.
5. Align drive axle inner joint flange with output shaft flange.
6. Install six new drive axle to output shaft screws and lockwashers. Tighten screws to 65 foot-pounds. Have helper apply brakes to prevent axle from rotating when installing screws.
7. Carefully remove wire supporting knuckle assembly, then lift up on upper control arm and install upper spherical joint stud in steering knuckle.
8. Install brake hose clip on upper spherical joint stud.
9. Install nut on upper spherical joint stud. Tighten nut to 60 foot-pounds and install cotter pin.

CAUTION: See Page 3-6.

10. Install brake hose bracket on frame.

CAUTION: Be careful not to twist brake hoses or otherwise damage the brake system.

11. Tighten shock absorber upper mount nut to 75 foot-pounds.
12. Install drive axle spindle washer and nut. Do not tighten nut at this time.
13. Install wheel and wheel mounting nuts. Do not tighten nuts at this time.
14. Remove rubber hose from lower control arm torsion bar connector and lower car.
15. Tighten wheel mounting nuts to 130 foot-pounds.

CAUTION: See Page 3-6.

16. Tighten drive axle spindle nut. After reaching 110 foot-pounds minimum, nut must always be tightened further, never backed off, to install cotter pin. Install new cotter pin. If cotter pin holes do not line up at this position, tighten nut further until pin can be installed.

CAUTION: See Page 3-6.

17. Install wheel disc.
18. Check final drive oil level and check for leaks at output shaft.

38. Outer Constant Velocity Joint (Ball Type)

The outer constant velocity joints are replaced as an assembly and are disassembled for repacking and replacement of seals only.

a. Disassembly

1. Insert axle assembly in vise. Clamp on mid-portion of axle shaft.

CAUTION: Protect axle shaft to prevent jaw marks from vise. If right drive axle is being worked on, use extreme caution when clamping on torsional damper.

2. Remove inner and outer seal band clamps as shown in Fig. 3-73.
3. Slide seal down axle to gain access to the constant velocity joint. Wipe excess grease from joint to permit access to the snap ring.
4. Using Snap Ring Pliers, J-8059, spread snap ring and slide joint off axle spline as shown in Fig. 3-74.

BACK TO INDEX

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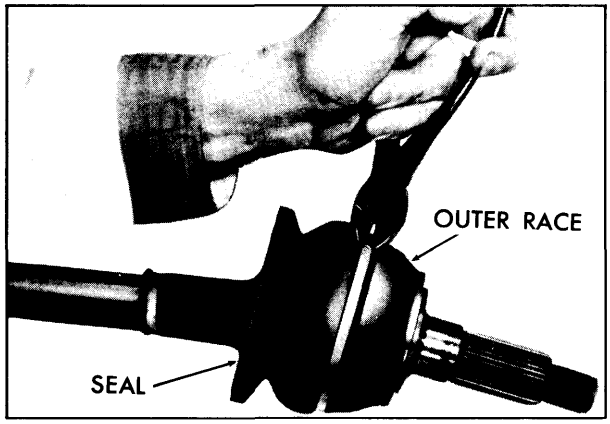


Fig. 3-73 Removing Seal Clamp Bands

5. Remove inner race snap ring as shown in Fig. 3-75.

6. Slide seal off axle shaft.

7. Insert joint in vise, clamping on shank. Use jaw blocks to prevent damage to joint shank.

8. Using a hammer and brass drift, tap on inner race until one ball can be removed, Fig. 3-76. Tip race in this manner to remove each ball. It may be necessary to pry last ball from cage with screwdriver.

9. Turn cage 90° as shown in Fig. 3-77 with slot in cage aligned with short land on outer race and lift cage out with inner race.

10. Turn short land of inner race 90° in line with hole in cage. Lift land on inner race up through hole in cage, then turn up and out to separate parts as shown in Fig. 3-78.

b. Cleaning and Inspection (Outer Joint)

Wash all parts thoroughly in a cleaning solvent and dry with compressed air. Inspect rubber seals for damage or wear. If seals are damaged or worn, replace with new seals.

(NOTE: If any of the first four defects are found, the constant velocity joint assembly must be replaced as a unit.)

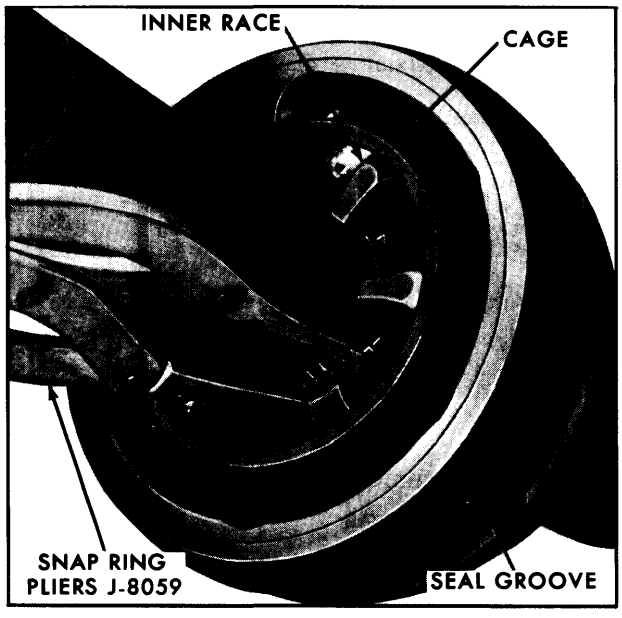


Fig. 3-74 Removing Outer Joint From Axle

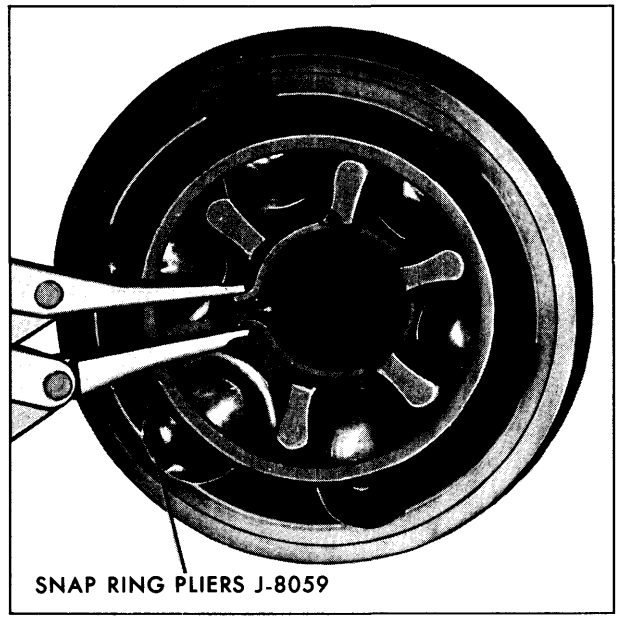


Fig. 3-75 Removing & Installing Inner Snap Ring

1. Inspect outer race for excessive wear or scoring in the ball grooves. Check housing splines and threads for any damage.

2. Inspect balls (six) for nicks, cracks, scores, or wear. Slight scuffing or nicking is considered normal.

3. Inspect cage for cracks, breaks, or excessive brinelling of the window flats.

4. Inspect inner race for excessive wear, scores, or cracks.

(NOTE: Inner and outer races may show a definite polished area where the balls travel but the CV joint need not be replaced. However, if the wear pattern is suspected to be the cause of a noisy or vibrating joint, replace joint.)

5. Inspect snap ring.

c. Assembly

1. Insert short land of inner race into slot in cage,

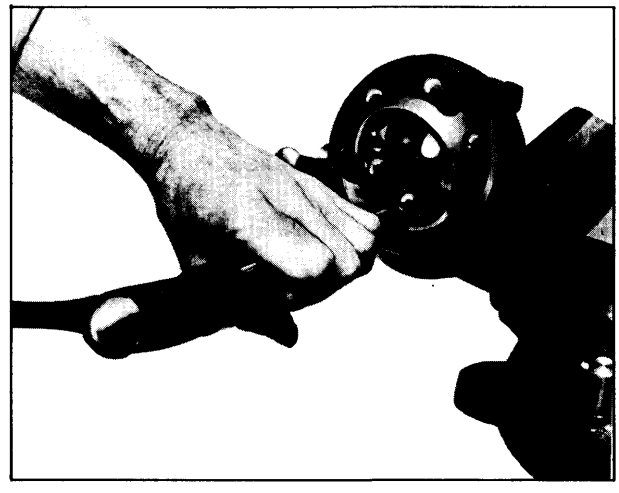


Fig. 3-76 Removing Balls From Outer Joint

BACK TO INDEX

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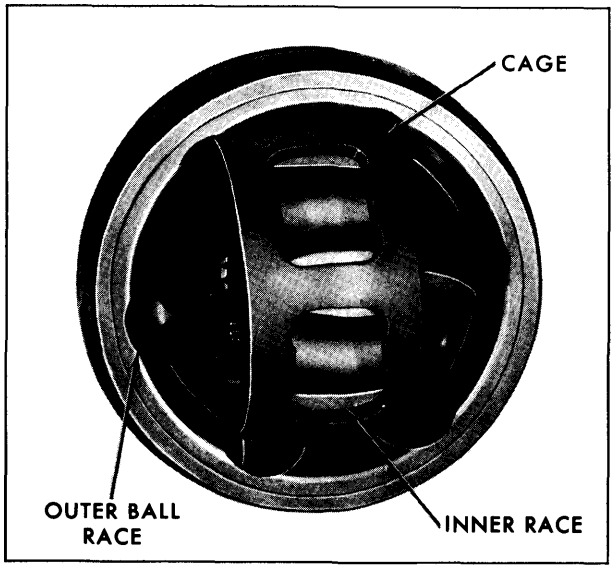


Fig. 3-77 Removing Cage and Inner Race

and pivot to install in cage shown in Fig. 3-78.

2. Pack constant velocity joint with special drive axle joint lubricant, Part No. 105 0802, or equivalent.

(NOTE: One can of lubricant will service one complete drive axle joint only.)

3. Insert cage and inner race into outer race by aligning windows on cage with lands on outer race, Fig. 3-77. Pivot cage and inner pace 90°.

(NOTE: Be certain that step on cage bore is positioned to inside of joint and snap ring groove on inner race is facing outside.)

4. Apply lubricant to the inner and outer race and insert balls into outer race one at a time until all six balls are installed. Inner race and cage will have to be tilted so that each ball can be inserted. Use of a hammer and brass drift may be helpful if a tight fit is encountered.

5. Position small end of seal in groove on axle shaft.

When installing outer joint seal on axle shaft, position small end of seal in outer groove in axle shaft, or groove nearest end of axle shaft, Fig. 3-79, and proceed as follows:

a. Loop seal clamp band around seal end twice with strap passing through its own retainer each time a loop is completed.

b. After completion of second loop, feed extra length of strap into small end of Seal Clamp Band Installer, J-22716. Be sure to have the open side of the tool facing up.

c. Slide bolt through holes in side of tool and, at the same time, secure strap in slot in the bolt.

d. Lift end of strap up and out of the open side of tool.

e. Place a wrench on bolt and draw band up tight, then torque bolt to 6-8 foot-pounds.

f. Rotate Seal Clamp Band Installer, J-22716, back over the band retainer.

g. Back tool off just enough to permit tapping band with a hammer until it lies flat across top of retainer. Tap the tabs down until they retain strap.

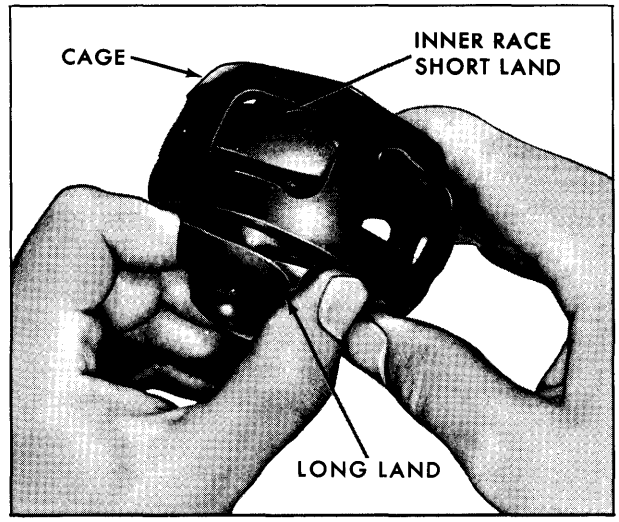


Fig. 3-78 Removing Inner Race From Cage

CAUTION: Tap lightly to avoid damaging seal.

h. Unwind the excess strap and cut it off close to retainer.

6. Pack inside of seal with approximately 1/4 pound of special drive axle joint lubricant, Part No. 105 0802, or equivalent.

7. Install snap ring into inner race as shown in Fig. 3-75.

8. Insert axle shaft into splines of outer constant velocity joint until snap ring secures shaft in second snap ring groove.

(NOTE: Snap ring must be spread to facilitate mating of axle shaft into splines of outer constant velocity joint.)

9. Position seal in groove of outer race.

(NOTE: Mating area of seal and outer race must be free of lubricant to obtain proper sealing.)

10. Install large seal clamp band over seal and install band.

(NOTE: Maximum diameter of band should be 4.52".)

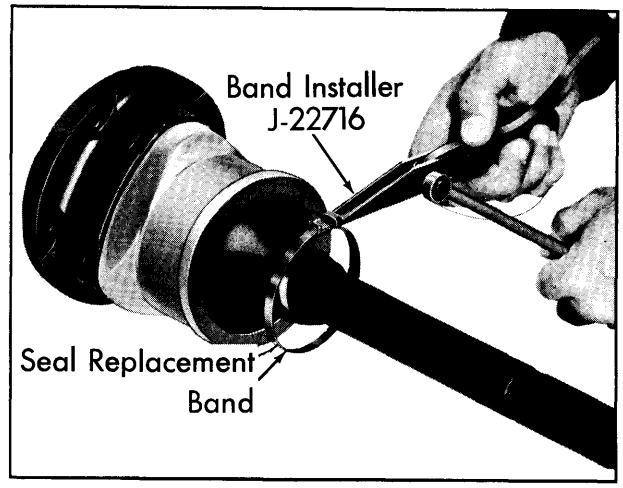


Fig. 3-79 Positioning Seal Clamp Band

BACK TO INDEX

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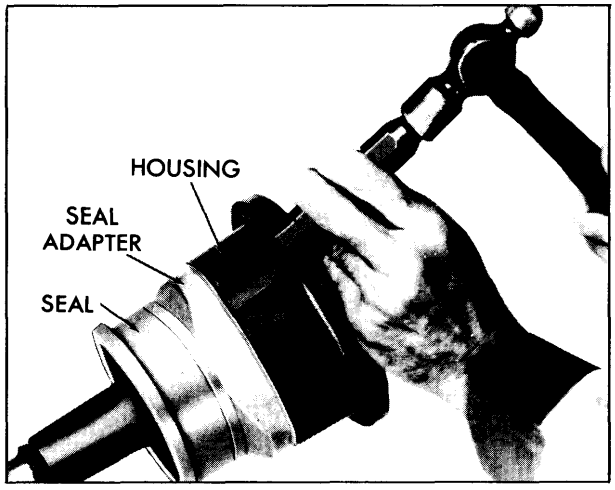


Fig. 3-80 Removing Seal Adapter From Joint Housing

39. Inner Joint

a. Disassembly

1. With axle assembly lying on a bench, pry up staked areas on seal retainer and drive off housing with hammer and chisel, Fig. 3-80.

2. Grasp axle assembly with one hand and joint housing with the other and stand both vertically on bench. Carefully withdraw axle from housing, being certain not to lose balls and needles from axle.

(NOTE: It may be helpful to place a rubber band over ends of spider to retain the three balls and needle bearings. Wipe all excess grease from joint. Set housing aside.)

3. Insert axle assembly in vise. Clamp on mid-portion of axle shaft.

CAUTION: Be careful when clamping to avoid damage to axle.

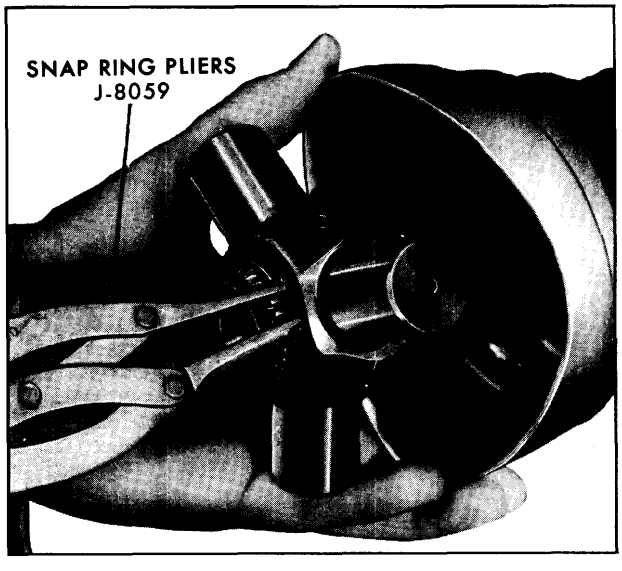


Fig. 3-81 Removing Spider Snap Ring

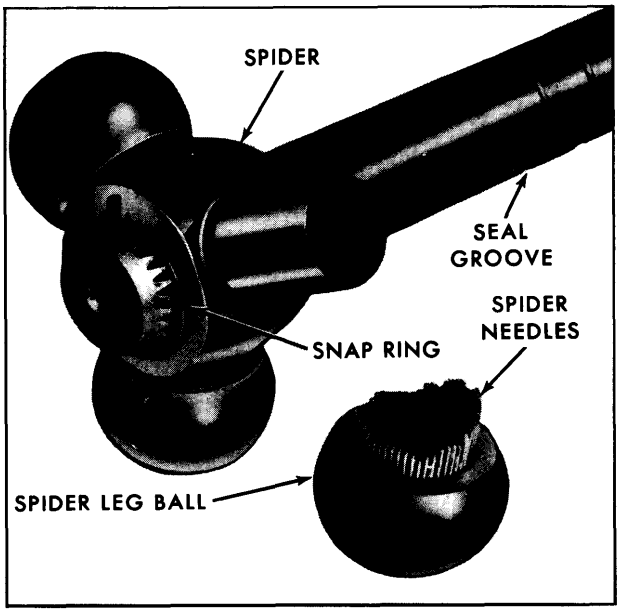


Fig. 3-82 Spider Assembly

4. Remove snap ring from end of axle shaft, Fig. 3-81.
5. Slide spider assembly, Fig. 3-82, from axle shaft.
6. Remove inner snap ring from axle shaft.
7. Remove small seal clamp.
8. Slide boot seal off axle shaft.
9. Remove three balls from spider, being careful not to lose any of the 53 needle bearings in each of the balls.
10. If necessary to remove tri-pot housing end cover or O-ring, proceed as follows:
   a. Secure housing in vise.
   b. Place a block of wood (approximately 2" x 2" x 8") in housing.
   c. Drive on wood block to push end cover out of housing.
   d. Remove housing O-ring and discard O-ring.

b. Cleaning and Inspection (Inner Joint)

Wash all parts thoroughly in a cleaning solvent and dry with compressed air. Inspect rubber seal and O-rings for damage or wear. If seal or O-rings are damaged or worn, replace with new seal or O-rings.

1. Inspect seal adapter band for bent or cracked condition.
2. Inspect tri-pot housing for excessive wear and brinelling.

(NOTE: Housing may show a definite polished area where the balls travel but joint need not be replaced. However, if this wear pattern is suspected to be the cause of noise or vibration complaint, replace joint.)

3. Inspect snap rings for distortion or damage.
4. Inspect spider leg balls for excessive wear, cracks, nicks, scores, or breaks.
5. Inspect spider leg ball needles for chips, breaks, or bends.
6. Inspect spider for excessive wear, scores, or cracks.

BACK TO INDEX

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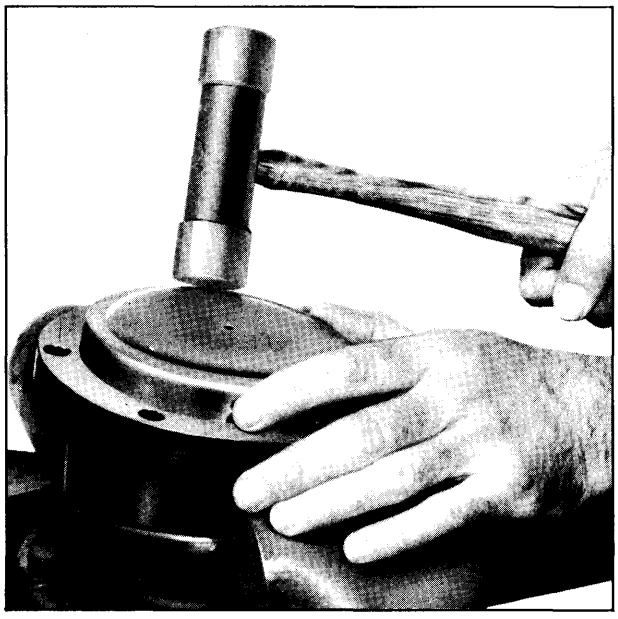


Fig. 3-83 Installing Tri-Pot Housing End Cover

c. Assembly

1. Slide new clamp onto axle shaft to be used after seal positioning.
2. Slide seal onto axle shaft.
3. Install inner snap ring on axle shaft.
4. If spider needles were removed, load 53 needles into each ball, lubricating with special drive axle lubricant, Part No. 105 0802, or equivalent.
5. Carefully install balls on each of the spider journals.

(NOTE: A rubber band may be used to retain balls in position until spider assembly is installed in housing.)

6. Position spider assembly on axle shaft and retain with outer snap ring.
7. If end cover and O-ring were removed, install new O-ring in housing, lubricate O-ring and install cover by tapping around outer edge of cover, Fig. 3-83.
8. Install O-ring in outer groove in housing.
9. Pack housing approximately one-half full with lubricant.
10. Remove rubber band, if used, from spider assembly.
11. Position spider assembly in line with housing assembly and push into housing until bottomed.
12. Fill housing with remainder of lubricant.
13. Swab inside of boot seal retainer and housing outer groove O-ring with lubricant.

CAUTION: Be careful that seal retainer is positioned so that O-ring is not cut.

14. With housing positioned as shown in Fig. 3-84. tap seal retainer on three lobes alternately with plastic hammer as shown until firmly bottomed, then stake three places into staking groove.
15. Extend inboard joint to maximum length and position seal into furthest groove from joint in axle.
16. Install seal clamp band on small end of seal, Fig. 3-84. Proceed as follows:

a. Loop seal clamp band around seal twice with strap passing through its own retainer each time a loop is completed, Fig. 3-79.

b. After completion of second loop, feed extra length of strap into small end of Seal Clamp Band Installer, J-22716.

(NOTE: Be sure to have the open side of the tool facing up.)

c. Slide bolt through holes in side of tool and at same time secure strap in slot in the bolt.

d. Lift strap up and out of open side of tool.

e. Place a wrench on bolt and draw band up tight, then torque bolts to 6-8 foot-pounds.

f. Rotate Seal Clamp Band Installer, J-22716, back over band retainer.

g. Back tool off just enough to permit tapping band with a hammer until it lies flat across top of retainer. Tap tabs down until they retain strap.

h. Unwind excess strap and cut it off close to retainer.

40. Right Output Shaft Bearing

a. Removal

1. Remove output shaft as described in Note 36a, Steps 1 through 10.
2. Remove three self-tapping screws securing output shaft bearing retainer to support.
3. Make two steel plates 1/4" x 3" x 8" and install in a vise as shown in Fig. 3-85.

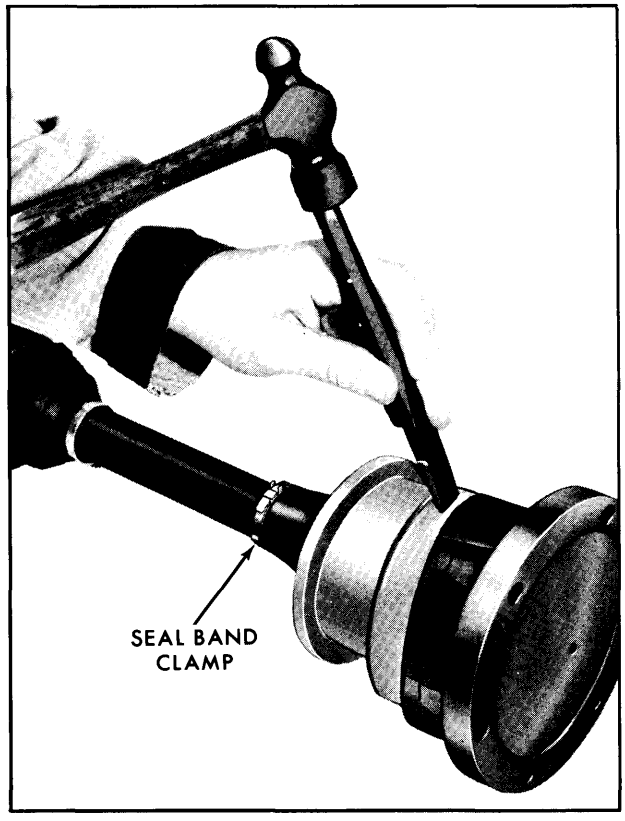


Fig. 3-84 Installing Seal Adapter on Joint Housing

BACK TO INDEX

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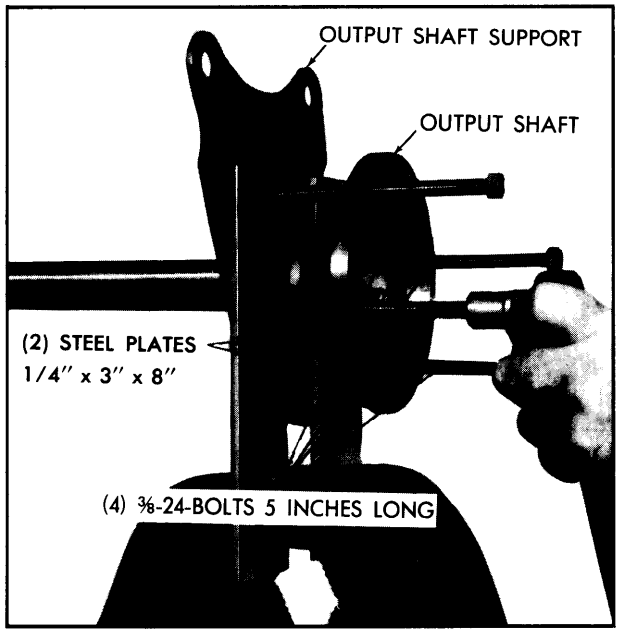


Fig. 3-85 Removing Right Outer Shaft Support and Bearing

4. Install four 3/8"-24 bolts (five inches long) on output shaft and install output shaft between steel plates in vise as shown in Fig. 3-85.

CAUTION: Use extreme care to prevent damage to seal surface on output shaft.

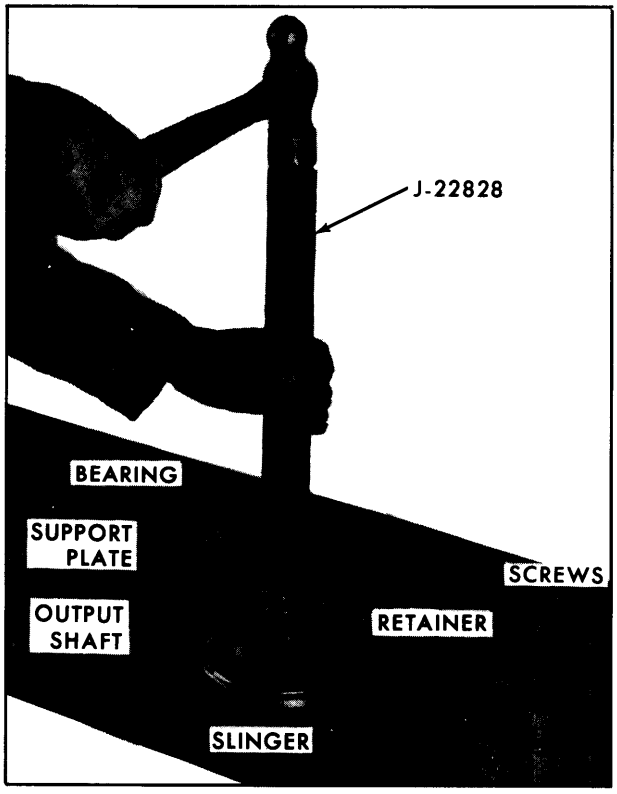


Fig. 3-86 Installing Right Outer Shaft Support and Bearing

5. Remove bearing assembly by tightening bolts alternately.

b. Installation

1. Position output shaft on flange end on a work bench, Fig. 3-86.
2. Lubricate output shaft support and install over splined end of output shaft.
3. Lubricate bearing and install, using a hammer and Bearing Installer, J-22828, Fig. 3-86.
4. Lubricate exposed face of bearing and install bearing retainer. Secure bearing retainer with three self-tapping screws.
5. Using a hammer and Bearing Installer, J-22828, install slinger as shown in Fig. 3-87.
6. Install output shaft as described in Note 36b, beginning with Step 3.

41. Output Shaft Seal Replacement

a. Removal

1. To replace right output shaft seal, remove right output shaft as described in Note 36a. Steps 1 through 10. Then remove seal from final drive unit with a pry bar and discard seal.

CAUTION: When removing seal, use extreme care to prevent damaging seal surface in final drive unit.

2. To replace left output shaft seal, remove left output shaft as described in Note 37a. Then remove seal

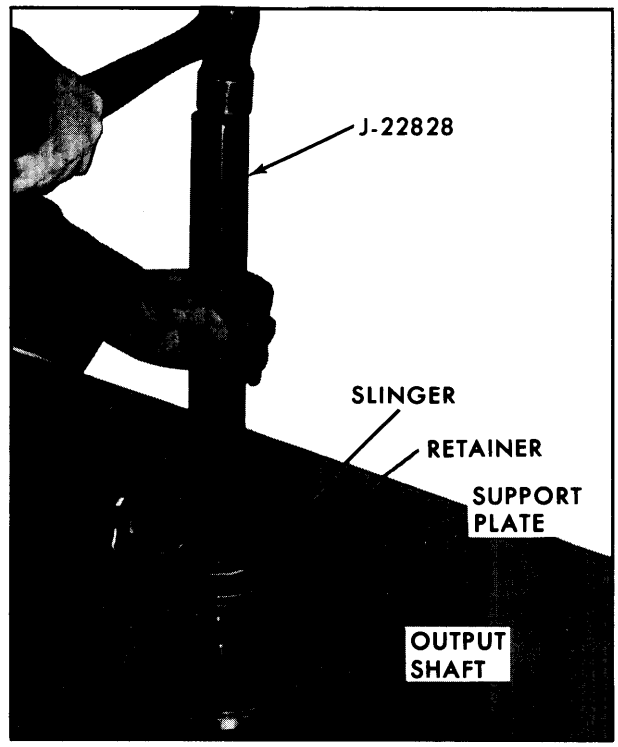


Fig. 3-87 Installing Right Output Shaft Support Slinger

BACK TO INDEX

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from final drive unit with a pry bar and discard seal.

CAUTION: When removing seal, use extreme care to prevent damaging seal surface in final drive unit.

b. Installation

1. To install right hand output shaft seal in final drive, attach Universal Handle, J-8092, to Seal Installer, J-22760. Then place seal in final drive unit and drive on Universal Handle, J-8092, until seal is installed. Apply clean front wheel bearing grease between lips of seal.

CAUTION: Rotate tools to maintain proper alignment when installing seal.

2. Install right hand output shaft as described in Note 35b, beginning with Step 3.

3. To install left hand output shaft seal in final drive, attach Universal Handle, J-8092, to Seal Installer, J-22199. Then place seal in final drive unit and drive on Universal Handle, J-8092, until seal is installed.

(NOTE: The left hand output shaft seal contains a hole for venting the final drive unit. The top of the seal is identified by the word "Top" and must be installed with the word "Top" positioned up so that vent will be in proper position.)

4. Install left hand output shaft as described in Note 37.

42. Final Drive

a. Removal

1. Raise hood and disconnect negative battery cable.

2. Remove bolt securing transmission filler tube bracket to final drive bracket and remove transmission filler tube.

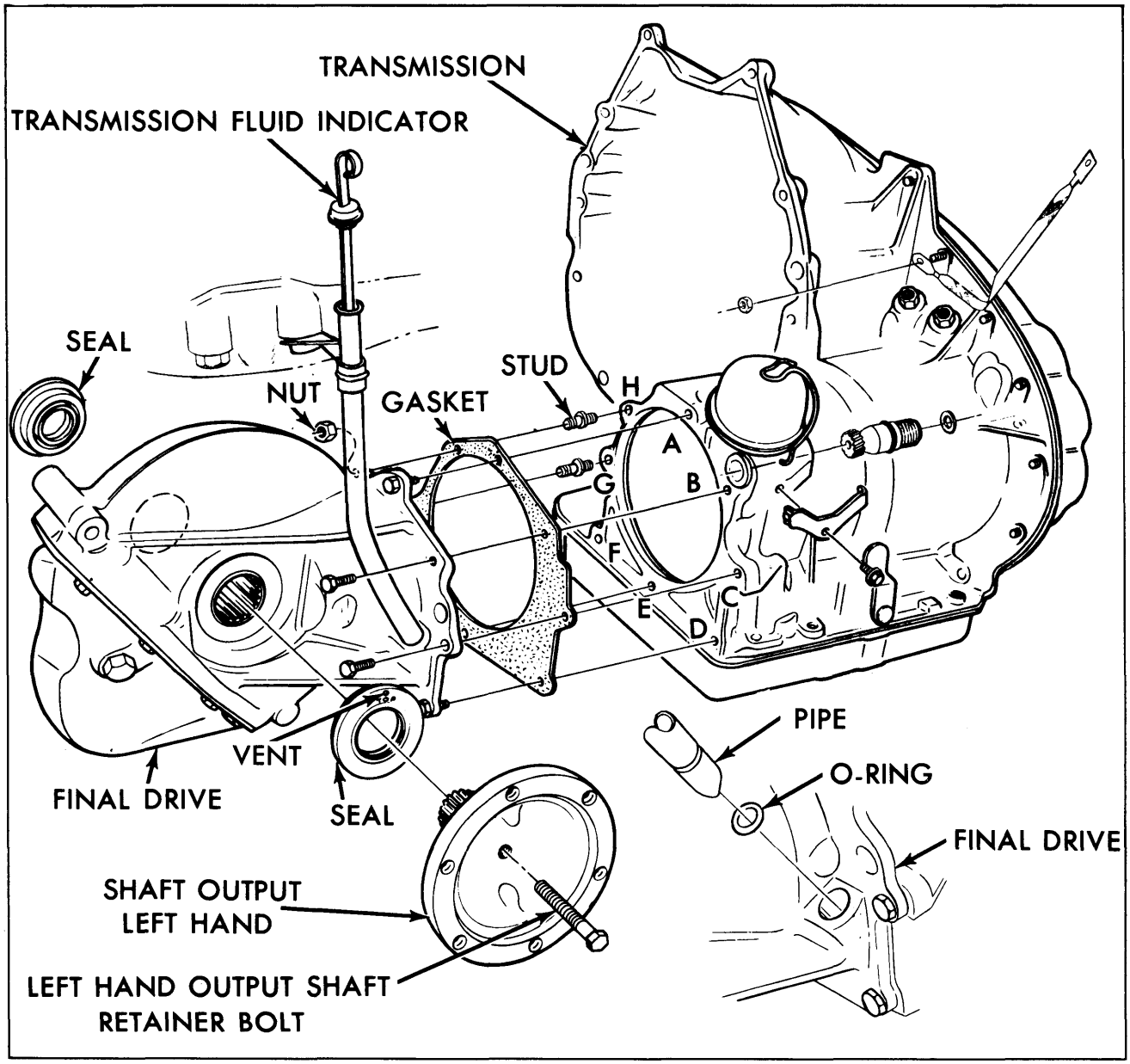


Fig. 3-88 Final Drive Attachment

BACK TO INDEX

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3. Remove screws "A" and "B" and nut "H" securing upper part of final drive housing to transmission housing. Fig. 3-88.

(NOTE: The use of a box end wrench with a crescent-shaped handle, such as a starter and manifold wrench, will facilitate removal of nut "H".)

4. Remove self-tapping screw securing transmission cooler lines and clip to final drive support bracket, Fig. 3-89, and slide clip out of way.

5. Remove locknut, washer, and long bolt securing final drive support brace to engine mount bracket, Fig. 3-89. (Use a second wrench to hold locknut in place while turning bolt.)

6. Remove right output shaft, following Note 36a. Steps 3 through 10.

7. WARNING: THE SHOCK ABSORBERS ACT AS REBOUND STOPS ON THE ELDORADO FRONT SUSPENSION. BEFORE PERFORMING THE FOLLOWING STEP, BE CERTAIN THAT RIGHT SHOCK ABSORBER LOWER SLEEVE CANNOT BE DISLODGED FROM MOUNTING STUD. REMOVING THE SHOCK FROM THE LOWER MOUNT MAY ALLOW THE LOWER CONTROL ARM TO DROP DOWN.

Place jack stands under front frame side rails. Lower hoist and move hoist equipment away from work area.

8. Place a drain pan under final drive cover. Loosen ten final drive cover screws and pull cover away from housing. Allow lubricant to drain while performing next four steps.

9. Remove six screws securing left drive axle to output shaft. Compress drive axle inner constant velocity joint and secure in this position to permit clearance for removal of final drive unit with left output shaft installed.

10. Remove bolt, washer, and nut securing left tie strut to frame cross member, loosen bolt securing strut to side rail, and rotate strut outboard until clear of final drive area.

11. Remove large through bolt, nut, and washers securing final drive support bracket to final drive. (Use a second wrench to hold nut stationary while turning bolt, Figs. 3-89 and 3-90.)

12. Remove final drive support bracket by lifting upward and outward.

13. Remove ten final drive cover screws and remove cover and cover gaskets.

14. The final drive assembly should be removed and installed with a transmission lift and a special adapter. Adapters are available commercially through lift equipment manufacturers. One such mechanism is shown in Fig. 3-91. All such adapters feature pivot points to provide a safe means of rotating the unit during lifting and lowering. Consult the instructions and recommendations of the manufacturer.

WARNING: TO AVOID PERSONAL INJURY, BE ABSOLUTELY CERTAIN THAT LIFT EQUIPMENT INDEPENDENTLY SUPPORTS AND HOLDS FINAL DRIVE UNIT BEFORE PERFORMING THIS STEP.

Place a drain pan under transmission and remove screws "C", "D", "E", and "F" and nut "G", Fig. 3-88.

15. Disengage final drive splines from transmission, Fig. 3-91, and allow unit to drain.

16. Remove final drive unit from underside of car by sliding unit toward front of car, permitting ring gear to rotate over steering linkage, and lowering housing from car.

17. Remove and discard final drive to transmission gasket.

b. Installation

1. Apply transmission fluid to transmission side of new gasket and place gasket on studs.

2. Attach final drive unit securely to transmission jack adapter. Lift unit to on-car position, aligning unit with two studs and aligning final drive and transmission splines, Fig. 3-91.

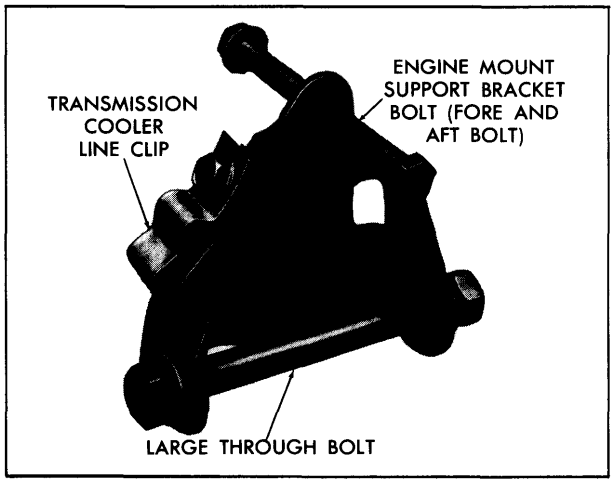


Fig. 3-89 Final Drive Support Bracket and Fasteners

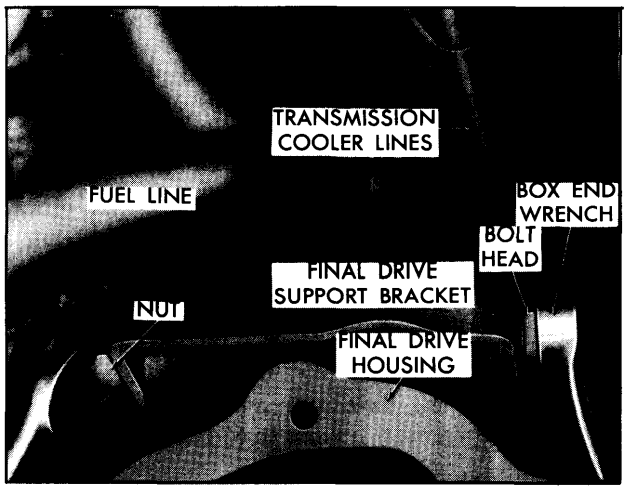


Fig. 3-90 Removing and Installing Through Bolt

BACK TO INDEX

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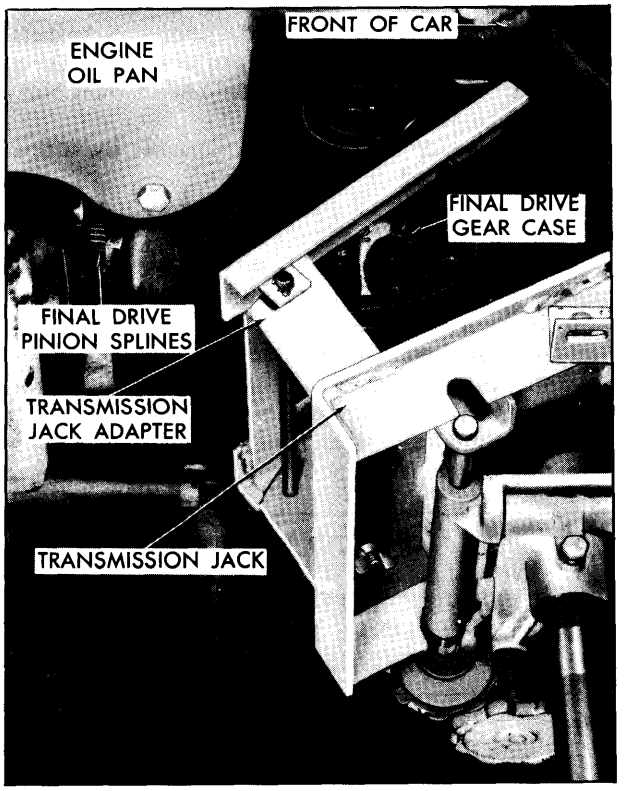


Fig. 3-91 Removing and Installing Final Drive

(NOTE: If splines do not line up, rotate left output shaft until splines can be engaged. Do not allow gasket to become mispositioned.)

3. Insert final drive support bracket as near as possible to proper installed position.

4. Insert large through bolt, nut, and washers and tighten with fingers, Fig. 3-89. Insert long bolt, washer, and locknut securing final drive support bracket to engine mount support and tighten with fingers. (If this "fore and aft" bolt cannot be installed, perform step 5; then insert bolt and proceed to step 6.)

5. Install screws "C", "D", "E", and "F" and nut "G"; tighten to 25 foot-pounds, Fig. 3-88.

6. Tighten large through bolt to 70 foot-pounds. (This torque is to be applied to head of bolt while nut is held, Fig. 3-90.)

7. Remove transmission jack and adapter assembly from final drive housing and remove assembly from work area.

8. Install final drive cover and new cover gaskets, tightening ten screws to 156 inch-pounds.

(NOTE: Two gaskets are used at the final drive cover to provide a vent for the unit. Thin, dark gray gasket must be installed next to housing, with slotted, light gray gasket on top–next to cover–for vent to be effective.)

9. Position left drive axle on output shaft and fasten with six screws, tightening to 65 foot-pounds.

(NOTE: Have a helper apply brakes to prevent axle from turning while tightening screws.)

10. Remove rubber hose previously installed on left torsion bar connector.

11. Install left tie strut on frame cross member, securing with bolt, nut, and washer. Tighten tie strut fastener at frame side rail.

12. Install right output shaft, support, and strut as an assembly, employing technique described in Note 36, Steps 3 through 8.

13. Fill final drive unit with lubricant Part No.7805942 or equivalent until within 1/2" of filler hole.

14. Lower car.

15. Tighten long bolt and locknut securing final drive support bracket to engine mount support to 20 foot-pounds, Fig. 3-89. (This torque is to be applied to locknut while holding bolt stationary.)

16. Install screws "A" and "B" and nut "H" securing upper part of final drive housing to transmission. Tighten to 25 foot-pounds, Fig. 3-88.

17. Install a new O-ring on transmission filler tube, Fig. 3-88.

18. Remove plug and install transmission filler tube, securing to exhaust manifold.

19. Slide transmission cooler line clip into place and secure clip to final drive support bracket with one screw, Fig. 3-89, tightening to 96 inch-pounds.

20. Connect negative battery cable.

21. Check engine oil level, start engine, and check transmission fluid level. Add fluid as required.

22. Check output shaft seals, final drive to transmission connection, and final drive cover for oil leaks.

43. Pinion Bearing Oil Seal Replacement

a. Removal

1. Remove final drive unit from car as described in Note 42a.

2. Working on bench, remove six pinion bearing housing to final drive case bolts.

3. Remove pinion bearing housing by applying a steady pull on splined end of pinion gear with one hand and gently rotating pinion bearing housing with other hand.

4. Remove pinion bearing housing O-ring and discard.

5. Inspect vent pin O-ring seal and replace if necessary.

6. Drive pinion gear oil seals from pinion bearing housing with a screwdriver.

CAUTION: Use extreme care to prevent damage to pinion bearing housing oil seal surface.

b. Installation

1. Place pinion gear oil seals back to back with spring on seals exposed.

2. Install oil seals on Seal Installer, J-22212.

3. Drive on Seal Installer, J-22212, until tool bottoms against housing.

4. Install a new pinion bearing O-ring in final drive case.

5. Install pinion gear in final drive case.

BACK TO INDEX

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6. Install Seal Protector, J-22236, over splined end of pinion gear.

7. Install pinion bearing housing over pinion gear. Gently rotate pinion bearing housing until properly seated in final drive case.

8. Install six pinion bearing housing to final drive case bolts. Tighten bolts to 35 foot-pounds.

9. Remove Seal Protector, J-22236.

10. Install final drive unit in car as described in Note 41b.

TORQUE SPECIFICATIONS (ELDORADO ONLY)

Material No.	Application	Thread Size	Foot-Pounds
286-M	Drive Axle Nut	1"-20	See Below**
GM 6010-M	Stabilizer Bracket to Frame Screw	3/8-16	35
301-M	Shock Absorber (upper) Nut	9/16-12	75
301-M	Shock Absorber (lower) Nut	9/16-12	75
300-M	Lower Control Arm Bushing Bolts	1/2-13	80*
300-M	Upper Control Arm Bushing Bolts	1/2-20	95*
301-M	Lower Spherical Joint Nut	9/16-18	80*
301-M	Upper Spherical Joint Nut	1/2-20	60*
286-M	Tie-Rod to Knuckle Nut	1/2-20	40*
300-M	Drive Axle to Output Shaft Screw	3/8-20	65
275-M	Output Shaft Support to Engine Block Screw	7/16-14	50
300-M	Left Hand Output Shaft Retainer Bolt	3/8-24	40
280-M	Bearing Retainer to Knuckle Screw	3/8-16	30
301-M	Final Drive Support Bracket to Engine Mount Support Nut	1/2-13	20
301-M	Upper Control Arm Spherical Joint to Arm Nut	5/16-18	25*
300-M	Final Drive Support Bracket to Final Drive Bolt	1/2-13	70
300-M	Final Drive to Transmission	3/8-16	25
301-M	Nut - Upper Control Arm Cam to Frame	1/2-20	95*
286-M	Tie Rod Adjuster Clamp Nut	3/8-24	22
286-M	Wheel Mounting Nuts	1/2-20	130*
			Inch-Pounds
GM 601	Transmission Cooler Line Clip to Final Drive Support Bracket Screw	5/16-12	96
GM 6010-M	Output Shaft Support to Brace Screw	5/16-18	144
GM 6010-M	Output Shaft Support Brace to Final Drive Screw	5/16-18	144
275-M	Final Drive Cover Screws	5/16-18	156
GM 6010-M	Bearing Retainer to Support Plate Screw	5/16-18	144
280-M	Torsion Bar Crossmember Bolt Nuts	5/16-18	120
SAE 1020-1022	Stabilizer Link Bolt Nuts	5/16-18	156

(NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings, and steel classifications.)

**After reaching 110 foot-pounds minimum, nut must always be tightened further, never backed off, to insert cotter pin.

*CAUTION: *These fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. Each must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.*

BACK TO INDEX

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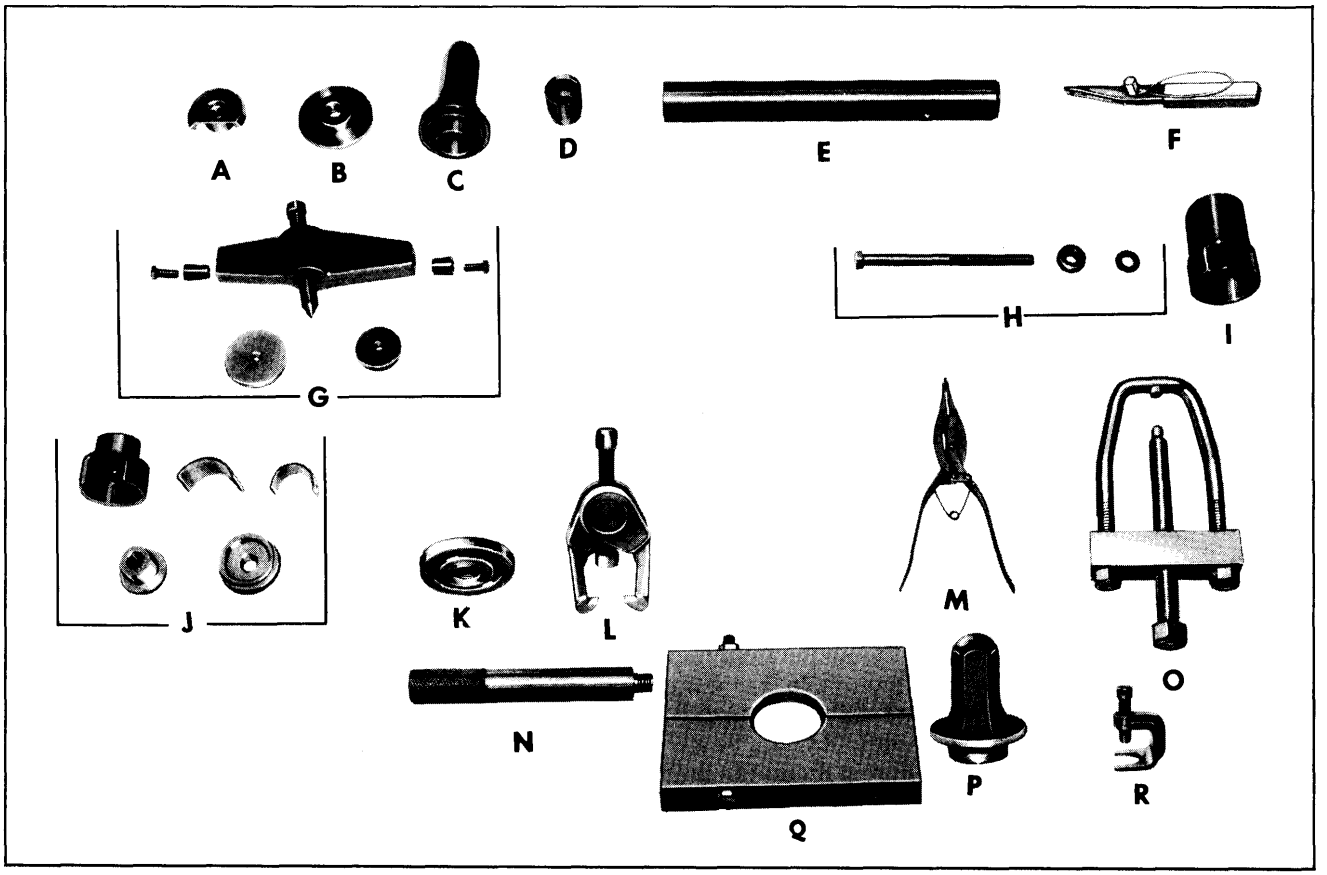


Fig. 3-92 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-22760	Right Output Shaft Seal Installer	J	J-22222	Bushing Remover and Installer Set
B	J-22199	Left Output Shaft Seal Installer	K	J-23114	Front Knuckle Outer Seal Installer
C	J-22212	Pinion Oil Seal Installer	L	J-24319	Front Suspension Puller
D	J-22236	Pinion Oil Seal Protector	M	J-8059	Snap Ring Pliers
E	J-22828	Output Shaft Bearing Installer	N	J-8092	Universal Handle
F	J-22716	Band Installer	O	J-22517	Torsion Bar Remover and Installer
G	J-22214	Knuckle and Bearing Remover	P	J-23115	Front Knuckle Inner Seal Installer
H	J-21474-3	Screw Assembly	Q	J-23997	Bearing Remover Press Plate
I	J-21474-5	Bushing Remover and Installer	R	5-5504	Stud Remover

BACK TO INDEX

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TABLE OF CONTENTS

Subject	Page No.
Rear Suspension	4-2
Rear Suspension—Eldorado	4-10
Automatic Level Control	4-15
Propeller Shaft	4-25
Rear Axle	4-36
Rear Axle—Eldorado	4-42
Differential	4-46

BACK TO INDEX

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GENERAL DESCRIPTION

A four link rear suspension system, Fig. 4-1, consisting of two upper and two lower control arms, steel coil springs, and shock absorbers is used on all conventional drive cars except the Commercial Chassis. The heavier Commercial Chassis uses semi-elliptical multiple leaf rear springs.

Two upper control arms are attached at their rear ends to inboard brackets on the rear axle housing and at their front ends to brackets on the rear suspension cross member. Two lower control arms are attached at their rear ends to outboard brackets on the rear axle housing and on their front ends to brackets on the frame side rails.

The rear shock absorbers are mounted at their upper ends in frame brackets to the rear of the axle center line. The lower ends are attached to mounting brackets on the axle housing.

On cars equipped with Automatic Level Control, bumper height adjustment is automatic.

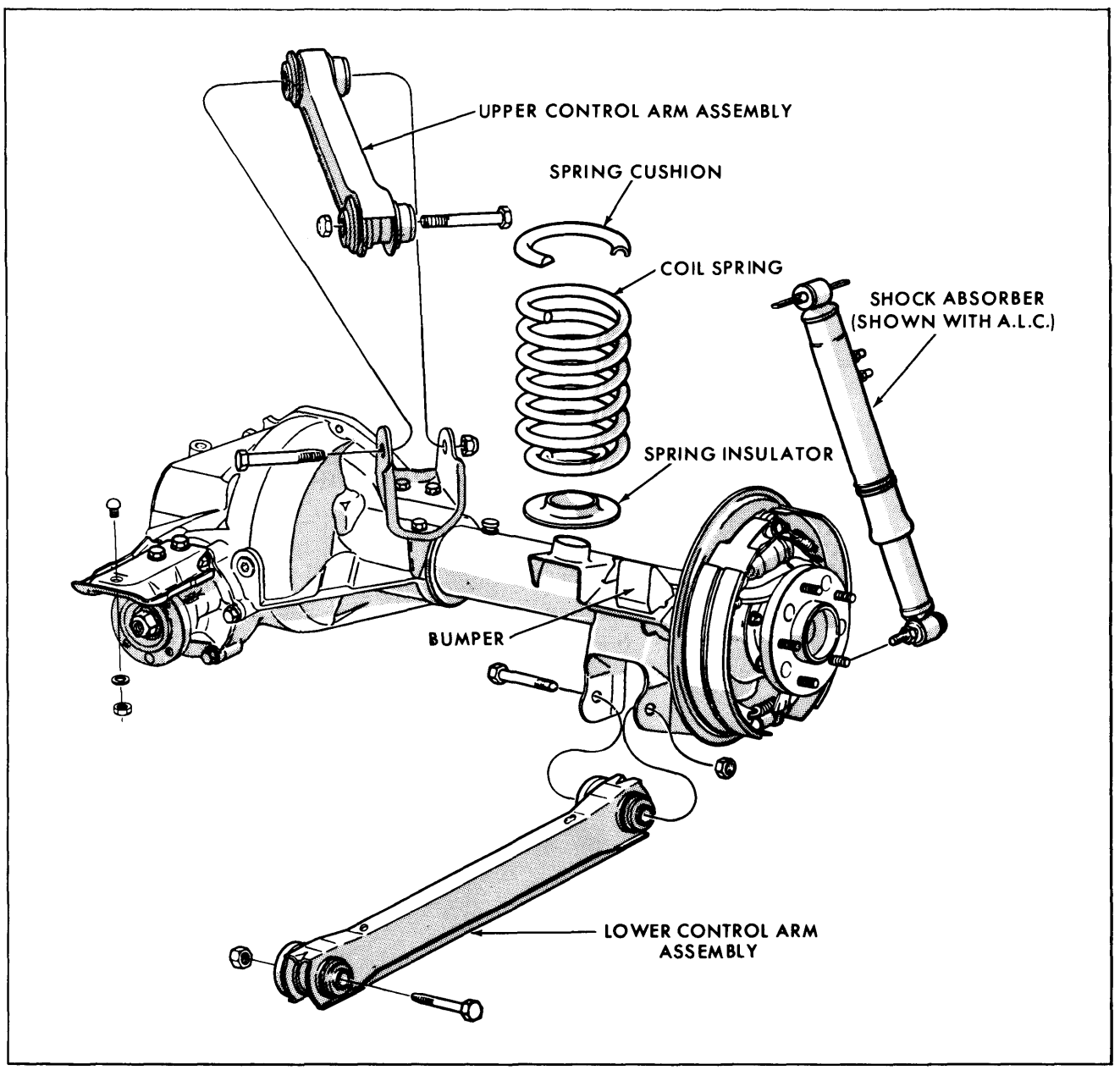


Fig. 4-1 Rear Suspension Disassembled

BACK TO INDEX

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Rear Suspension System–Commercial Chassis Only

The rear springs are of the semi-elliptical multiple leaf type. They have seven leaves, 2-1/2 inches wide, with zinc inner liners between the first four leaves to provide correct interleaf friction and prevent corrosion. Tip liners are provided at the spring end for noise isolation and to further reduce friction. The spring eyes are cushioned at each end by rubber bushings and at the spring seats on the axle housing by rubber insulating pads.

Service information pertaining to the rear suspension system on the Eldorado is covered at the back of this section.

SERVICE INFORMATION—EXCEPT ELDORADO

CAUTION: When raising rear of car, support vehicle weight at frame or axle or both. Never use control arms as contact points for hoist or jack stands as damage may result.

CAUTION: If any mispositioning, incorrect assembly, or failure of components in the area of the brake system pipes, hoses, or cylinders is observed, be sure to check for any brake damage that may have resulted from such a condition and correct as required. Components that could damage the brake system due to mispositioning, incorrect assembly, or failure include the exhaust system, shock absorbers, springs, and suspension control arms.

The following caution applies to certain steps in the assembly procedure of components in this section. The critical fasteners to which this caution applies are identified by the terminology

See CAUTION on Page 4-3.

CAUTION: This fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

1. Checking Rear Standing Height

Before checking standing (spring) height, make sure that trunk is empty except for spare tire and jack and that there is a full tank of gasoline, as all specifications are based on this observed weight. If car is equipped with Automatic Level Control, deflate system using service valve, then disconnect air line from superlift port on control valve. Deflation of the system is necessary when determining the standing height on the basis of springs alone When checking standing height to determine the proper functioning and adjustment of the Automatic Level Height Control Valve, the system must be connected and the reservoir charged with 100-140 psi. Normalize position of springs by bouncing bumper up and down, gradually reducing force applied, to permit car to assume its normal position.

a. Rear Springs

Measure distance from frame to axle, Fig. 4-2. Rear standing heights should be equal within 1/2 inch from side to side. Spring that checks below specifications must be replaced.

b. Ride Complaints

In case of hard riding, the first items to investigate are tire pressures, standing heights, and shock absorbers.

If these are correct, the amount of friction in the rear suspension system should be checked.

The procedure for checking excessive friction in the rear suspension system is as follows:

1. Disconnect rear shock absorbers.
2. With aid of a helper, lift up on the rear bumper and raise car as high as possible. Slowly release the bumper and allow the car to assume normal standing height. Measure distance from floor to center of bumper. Then push down on bumper, release slowly, and allow car to assume normal standing height. Measure distance from floor to center of bumper.
3. The difference between the two measurements should be less than 1/2 inch. If the difference exceeds the limit, inspect the upper and lower control arms for damaged or worn parts.

BACK TO INDEX

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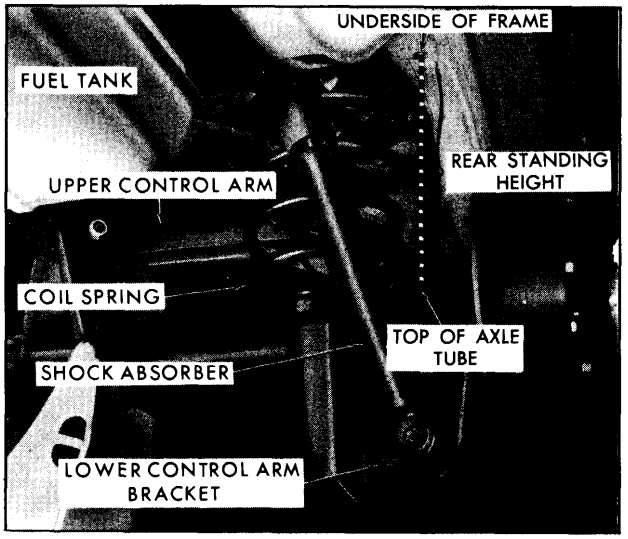


Fig. 4-2 Measuring Rear Standing Height

2. Rear Shock Absorbers

CAUTION: Be careful not to damage brake pipes or hoses throughout procedure.

a. Removal

1. Raise car so that both frame and axle are supported.

2. If car is equipped with Automatic Level Control, remove the air line fittings at shock absorbers.

WARNING: THE SHOCK ABSORBERS ACT AS REBOUND STOPS FOR THE REAR SUSPENSION. UNDER NO CIRCUMSTANCES SHOULD REAR END OF CAR EVER BE RAISED SO THAT REAR SUSPENSION IS IN REBOUND POSITION WHILE DISCONNECTING SHOCK ABSORBER UNLESS BOTH REAR AXLE AND FRAME ARE SUPPORTED, AS THIS COULD CAUSE INJURY OR DAMAGE.

3. Remove shock absorber upper retaining bolts and nuts. It may be necessary to fashion a simple tool for this operation. Bend a 1/2 inch box end wrench to a 45° angle at a point one inch from the center of the box end diameter, Fig. 4-3. Use this to hold each upper mounting nut at rear frame kick-up while removing mounting bolts.

4. Remove shock absorber lower retaining nut. It will be necessary to hold stem next to grommet to keep stem from turning, while removing nut with second wrench.

5. Remove shock absorber from its mounts.

b. Installation

1. On "C" cars, position the cross bar of the upper mount to the frame so that the shock angles naturally toward the lower mount. On commercial series, guide the upper shock absorber stem into mount. Install shock absorber upper attachment using special wrench used on removal.

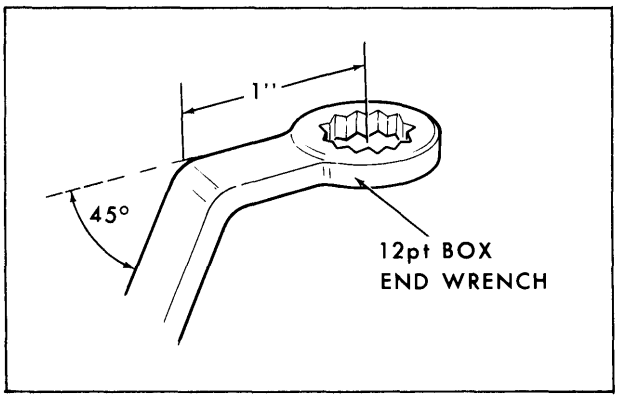


Fig. 4-3 Rear Shock Absorber Wrench

2. Install upper retaining nuts and bolts. Use special wrench used in Step 3a to hold nut while tightening bolt with a second wrench, tightening to 12 foot-pounds.

3. Guide shock absorber lower stud into mounting bracket and install retaining nut, tightening to 50 foot-pounds.

4. If car is equipped with Automatic Level Control, perform the following steps:

a. Install air line fittings at shock absorbers, tightening tube nuts to 30-40 inch pounds.

b. Inflate reservoir through service valve to 140 psi (or maximum pressure available).

c. Disconnect overtravel lever at axle bracket and push arm up, allowing air to enter superlift.

CAUTION: Do not put car weight on shock absorbers until they have been inflated as damage may result.

d. Return overtravel lever to normal position and reconnect arm to axle bracket.

5. Lower car.

6. If car is equipped with Automatic Level Control, check system for proper operation as described in Note 13.

3. Checking Rear Shock Absorbers

a. On Car Checks

1. Raise car on hoist.

2. Check for correct mounting of shock absorbers. If properly mounted, continue with next step.

3. Disconnect lower shock mount. Extend shock absorber and check to see if piston rod and seal (top of shock) cover is wet with a fresh film of oil. If oil is detected on rear shock absorber, remove the unit for bench check. (This check cannot be made on Automatic Level Control shock absorbers.)

4. If no oil is detected, pump shock absorber up and down by hand as fast as possible. If a skip is felt at end of stroke, remove shock absorber for bench check.

5. As another check, completely extend shock absorber and pull hard. If spring tension is felt, shock absorber should be replaced.

(NOTE: Pumping shock absorber by hand will not fully determine whether a shock absorber is good or bad. The best test method is to compare the questionable

BACK TO INDEX

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shock absorber with its mate on opposite side of car; that is, a front with the other front, and rear with the other rear. If both shocks feel the same, it is unlikely that a shock absorber replacement is necessary. Bad shocks, as detected by this test, will affect ride motion only.)

b. On Bench Checks – Standard Shock Absorbers

1. When performing a bench check for any suspected shock absorber, clamp shock absorber upside down in a vise.

(NOTE: Cadillac standard shock absorbers can be turned upside down because all internal vapor (inert gas instead of air) is contained in a pliacell envelope which prevents aeration of oil and prevents lag. If a lag is noticed when stroked, it means the pliacell envelope has been ruptured and the shock should be replaced.)

2. Pump shock absorber by hand at various rates of speed to find if shock absorber is defective. If a skip is felt at full extension when the shock is inverted, this is normal. A skip on reversal of direction in mid-travel indicates a ruptured pliacell envelope. If smooth resistance is felt throughout length of the stroke, however, the shock absorber need not be replaced. A faint hiss ("orifice swish") is considered normal, but a gurgling noise denotes air bubbles in the fluid, and the shock absorber should be replaced.

c. On Bench Checks – Automatic Level Control Shock Absorbers

1. Clamp lower mounting ring in vise in vertical position.
2. Extend and collapse shock completely several times to discharge air out of the working chamber.
3. Pump unit by hand at different rates of speed. Smooth resistance should be felt throughout the length of the stroke. Since the shock absorber is normally pressurized, the sound of air bubbles or a gurgling noise is normal.

4. Rear Springs

a. Removal

1. Raise car so that both rear axle and frame are supported.
2. If car is equipped with Automatic Level Control, disconnect link at overtravel lever by removing attaching nut. Position overtravel lever in center position.

3. WARNING: THE SHOCK ABSORBERS ACT AS REBOUND STOPS ON THE REAR SUSPENSION SYSTEM. DO NOT PERFORM THIS STEP UNLESS BOTH AXLE AND FRAME ARE FIRMLY SUPPORTED AS INJURY OR DAMAGE COULD RESULT.

Remove both shock absorber lower retaining nuts and stems from mounts. It will be necessary to hold the stem next to the rubber grommet with one wrench to prevent the stem from turning, while removing retaining nut with a second wrench.

4. Place jack stand under pinion retainer to relieve tension on control arm bolts and remove bolts and nuts securing upper control arms to axle brackets.
5. Remove four screws and lockwashers securing propeller shaft rear flange to pinion flange and support propeller shaft with wire or fan belt, Fig. 4-30.
6. Remove jack stand from under pinion retainer.

7. WARNING: IF AXLE IS ALLOWED TO WIND UP AS IT IS LOWERED, SPRINGS MAY SNAP FROM THEIR SEATS AND COULD CAUSE INJURY OR DAMAGE. USE EXTREME CAUTION TO PREVENT WIND-UP CONDITION.

Lower axle slowly until brake hose loses almost all slack. Compress springs by hand if necessary to lift off seats, and remove springs from car.

CAUTION: Under no circumstances is the axle to be lowered to the point at which brake hoses become taut, as damage may result.

8. Inspect upper and lower spring insulators and replace if required.

b. Installation

1. Position lower rubber insulator on rear axle housing mount.
2. Tape upper rubber insulator to top of spring and position spring so that end of top of spring is properly aligned with recess in upper seat of frame tower. Spring position should be within limits shown in Fig. 4-4.
3. Seat bottom of spring on lower rubber insulator.
4. Raise rear axle on hoist and check spring position.
5. Install lower shock absorber stems in mounts.
6. Install one nut at each mount. Torque nuts to 50 foot-pounds.
7. Position rear upper control arms in axle brackets and secure each with one bolt and nut. Do not torque nuts at this time.
8. Raise rear axle to on-car position.

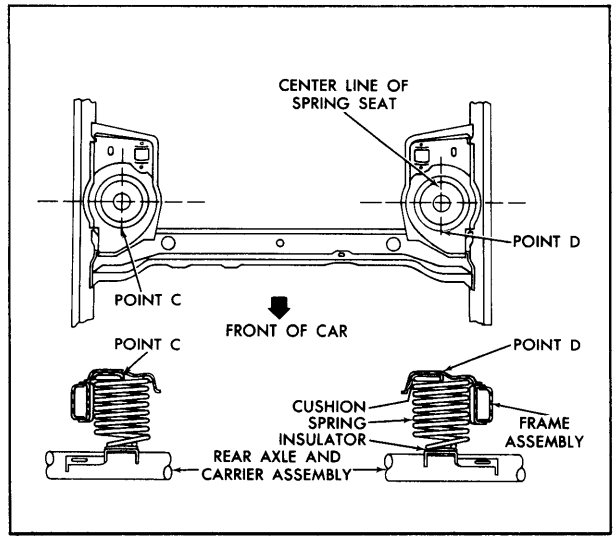


Fig. 4-4 Coil Spring Indexing

BACK TO INDEX

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9. On cars equipped with Automatic Level Control, perform the following steps:

a. Install air line fittings at shock absorbers, tightening tube nuts to 30-40 inch-pounds.

b. Inflate reservoir to 140 psi (or maximum pressure available) through compressor service valve.

c. Lift overtravel lever allowing air to enter shock absorbers.

d. Release overtravel lever and secure to axle with one nut.

10. Secure propeller shaft rear flange to pinion flange with four screws and lockwashers, tightening to 70 foot-pounds.

See CAUTION on Page 4-3.

11. Remove jack stands and lower car. Vehicle is now at standing height.

12. Tighten upper control arm nuts to 75 foot-pounds.

See CAUTION on Page 4-3.

CAUTION: Pivot bolt and nut in control arms must be torqued when normal vehicle weight is applied to axle. If not, the ride may be adversely affected.

6. Rear Lower Control Arm

WARNING: IF BOTH CONTROL ARMS ARE TO BE REPLACED, REMOVE AND REPLACE ONE CONTROL ARM AT A TIME TO PREVENT THE AXLE FROM ROLLING OR SLIPPING SIDEWAYS AS THIS MIGHT OCCUR WITH BOTH UPPER CONTROL ARMS REMOVED MAKING REPLACEMENT DIFFICULT.

CAUTION: Be careful not to damage brake piping on axle housing throughout this procedure.

a. Removal (Fig. 4-1)

1. Raise rear end of car.
2. Remove front and rear lower control arm nuts.
3. Place jack under front of differential to relieve tension on lower arm bolts.
4. Remove front and rear lower control bolts and remove arm.

(Neither front nor rear bushings in the lower control arms are serviceable.)

b. Installation

1. Slide lower control arm into position with the slotted hole in top of arm toward rear of car; flanged ends of bushings must face right side of car. Install front bolt from outboard side, and rear bolt from inboard side. Adjust jack under front of differential as necessary to install bolts.
2. Lower car.
3. Install front and rear lower control arm nuts, tightening to 75 foot-pounds.

See CAUTION on Page 4-3.

CAUTION: Pivot bolts in control arms must always be torqued when full normal load is applied to axle. If not, the ride rate may be adversely affected.

7. Rear Upper Control Arm

WARNING: IF BOTH CONTROL ARMS ARE TO BE REPLACED, REMOVE AND REPLACE ONE CONTROL ARM AT A TIME TO PREVENT THE AXLE FROM ROLLING OR SLIPPING SIDEWAYS AS THIS MIGHT OCCUR WITH BOTH UPPER CONTROL ARMS REMOVED, MAKING REPLACEMENT DIFFICULT.

a. Removal

1. Raise rear end of car.
2. If car is equipped with Automatic Level Control, remove attaching nut that secures height control valve link to left upper control arm. Position overtravel lever in center position.
3. Place jack stand under differential pinion retainer.
4. Remove both front and rear mounting nuts from control arm bolts.
5. Remove both control arm pivot bolts and remove control arm. (Neither front nor rear upper control arm bushings are serviceable.)

b. Installation

1. Install control arm with flanged surfaces of bushings inboard.
2. Loosely install front pivot bolt and nut.
3. Loosely install rear pivot bolt and nut in axle bracket.
4. Lower car.
5. Tighten front and rear nuts to 75 foot-pounds.

See CAUTION on Page 4-3.

CAUTION: Pivot bolts in control arms must always be torqued when full normal load is applied to axle. If not, the ride rate may be adversely affected.

6. If car is equipped with Automatic Level Control, secure link to left upper control arm with attaching nut. Inflate reservoir to 140 psi or maximum pressure available through compressor service valve.

8. Rear Leaf Spring Liner Service—Commercial Chassis

Replacement rear spring liner tips are available for installation between the spring leaves when original liners wear at the outer ends.

To install these replacement liner tips, it is necessary

BACK TO INDEX

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to use a hardwood wedge 2-1/2 inches wide, 5 inches long, and tapered from 1/8 inch to 3/4 inch thick in 2 inches of length. Proceed as follows:

1. Remove spring rebound clips.
2. Raise rear of car until springs are in full rebound position.
3. Mark off length of replacement liner tip on main spring leaf, allowing 1/2 inch projection beyond second leaf.
4. After carefully placing a piece of sheet metal between liner and spring leaf to protect leaf, pry first and second leaf apart and insert wedge under liner just beyond old liner.

CAUTION: It is necessary to protect the spring leaf because a small nick in the leaf from a steel wedge could cause a point of fatigue that might result in spring failure. Use a hardwood wedge whenever possible.

5. Remove original liner.
6. Install new liner tip with button end toward axle. Work out wedge keeping liner tip in position.
7. Repeat above operation at each of the two upper liners in each rear spring.

9. Rear Leaf Spring—Commercial Chassis

a. Removal

1. Raise car so that weight of body is entirely off the spring and support axle housing with adjustable stands.
2. Remove front eye bolt nut and drive out eye bolt.
3. Disconnect shock absorber from U-bolt plate.
4. Remove rear shackle link nuts, Fig. 4-5.
5. Remove U-bolt nuts, washers, lower spring plate, lower insulator retainer, and insulator pad.
6. Remove spring from frame attachment by disconnecting rear shackle link assemblies.

b. Installation

1. Install new bushings in spring eyes and in shackle-to-frame mounting sleeves.
2. Install shackle link on frame.
3. Install shackle link on spring and attach this assembly to shackle link on frame. Install nuts loosely.
4. Line up front spring eye on bracket on frame and install bolt from inner side of frame. Install nut, but do not tighten until car is lowered.
5. Install insulator pad and retainer on top of spring, with hole in pad and retainer over spring center bolt.
6. Position center of spring under rear axle housing bracket with spring center bolt located in hole provided in bracket.
7. Install insulator pad, retainer, and U-bolts; and install U-bolt nuts and lockwasher, torquing to 45 foot-pounds.

(NOTE: Lower car before tightening U-bolts or rear shackle nuts. This permits rubber bushings to take a neutral position and assures a more accurate torquing.)

8. Connect rear shock absorber at spring U-bolt plate.
9. Tighten front eye bolt and rear shackle link nuts to 70 foot-pounds.

See CAUTION on Page 4-3.

10. Rear Wheel Stud Replacement

a. Removal

1. Remove rear wheel shield and wheel disc.
2. Loosen wheel mounting nuts.
3. Raise rear end of car and place jack stands under rear frame rails.
4. Remove wheel mounting nuts and remove wheel. (Remove wheel spacer on Commercial Chassis.)
5. Remove push nut securing brake drum to axle shaft flange. (Push nut is not used on Commercial series cars.)
6. Remove brake drum.
7. Install tool J-5504 on damaged stud and press stud from axle shaft flange, Fig. 4-6.

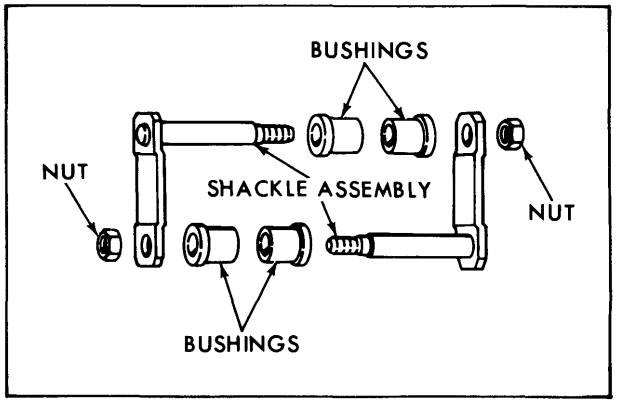


Fig. 4-5 Rear Leaf Spring Shackle

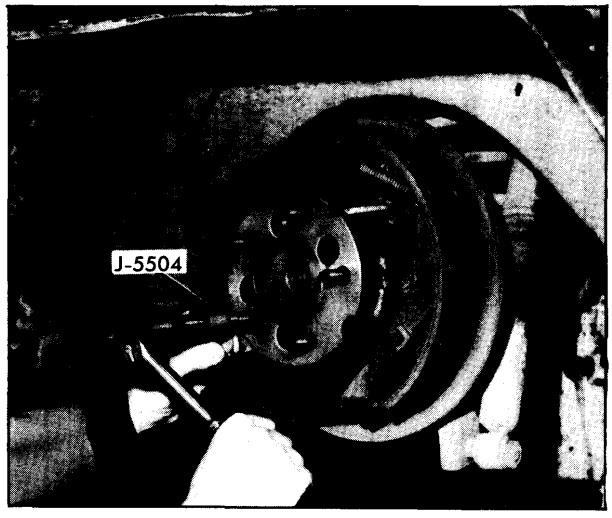


Fig. 4-6 Removing Wheel Stud

BACK TO INDEX

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(NOTE: Optional tool J-22292-1 may be used for this application. Either tool must be modified by cutting 1/4" off the end of each leg.)

b. Installation

1. Insert new stud from back side of axle shaft flange.
2. Install two flat washers on stud and wheel nut, flat side toward washers, and tighten nut with fingers.
3. Torque nut to 140 foot-pounds, Fig. 4-7.
4. Remove nut and washers from stud and discard.
5. Visually check stud threads and stud to make certain they are properly seated on inside of axle shaft flange.
6. Install brake drum.
7. Install one push nut securing brake drum to axle shaft flange, except on Commercial Chassis. (Install wheel spacer on Commercial Chassis.)
8. Install wheel and replace wheel mounting nuts.
9. Remove jack stands, lower car, and tighten wheel mounting nuts to 100 foot-pounds.

See CAUTION on page 4-3.

10. Drive car around several blocks making left and right turns.



Fig. 4-7 Installing Wheel Stud

11. Re-torque wheel mounting nuts to 100 foot-pounds.
12. Install wheel disc and wheel shield.

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot Pounds
300-M	All Upper and Lower Control Arm Nuts (while holding bolts)	1/2–13	75*
300-M	All Upper and Lower Control Arm Bolts (while holding nuts)	1/2–13	95*
300-M	Rear Leaf Spring U-Bolt Nuts	1/2–13	45
1020	Rear Leaf Spring Front I-Bolt Nut	1/2–20	45*
1020	Rear Leaf Spring Shackle Nuts	1/2–20	45*
275-M	Rear Shock Absorber Bolts (upper)	5/16–18	12
286-M	Rear Self Locking Shock Attaching Nut (lower)	1/2–20	50

NOTE: Refer to back of Manual, Page 16-1 for Bolt and Nut Markings, and Steel Classifications.

**These fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. Each must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.*

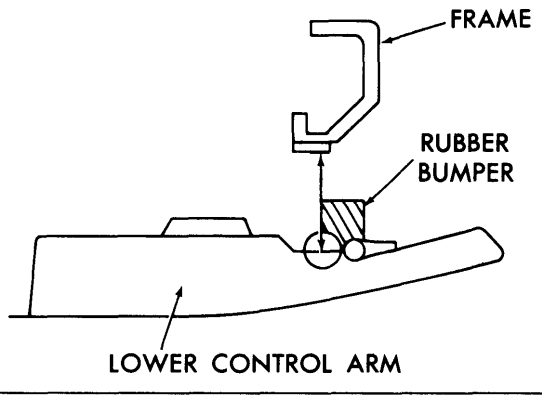
BACK TO INDEX

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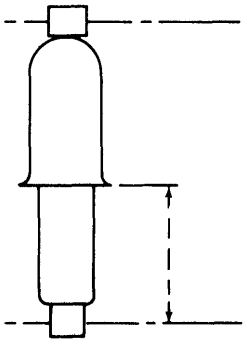
VEHICLE STANDING HEIGHTS			
STYLE		FRONT STANDING HEIGHT (INCHES)	REAR STANDING HEIGHT (INCHES)
CALAIS COUPE	STANDARD	3-15/16 TO 4-11/16	5-3/8 TO 6-1/8
	WITH ALC	3-15/16 TO 4-11/16	4-7/8 TO 5-5/8
CALAIS SEDAN	STANDARD	3-15/16 TO 4-11/16	5-3/8 TO 6-1/8
	WITH ALC	3-15/16 TO 4-11/16	4-7/8 TO 5-5/8
COUPE DE VILLE	STANDARD	3-15/16 TO 4-11/16	5-3/8 TO 6-1/8
	WITH ALC	3-15/16 TO 4-11/16	4-7/8 TO 5-5/8
SEDAN DE VILLE	STANDARD	3-15/16 TO 4-11/16	5-3/8 TO 6-1/8
	WITH ALC	3-15/16 TO 4-11/16	4-7/8 TO 5-5/8
FLEETWOOD BROUGHAM	STANDARD	3-7/8 TO 4-5/8	4-7/8 TO 5-5/8
FLEETWOOD 75 SEDAN	STANDARD	4-5/8 TO 5-5/16	6-1/16 TO 6-7/8
FLEETWOOD 75 LIMO	STANDARD	4-5/8 TO 5-5/16	6-1/16 TO 6-7/8
ELDORADO COUPE	STANDARD	8-3/16 TO 8-7/16	4-13/16 TO 5-9/16
ELDORADO CONVERTIBLE	STANDARD	8-3/16 TO 8-7/16	4-13/16 TO 5-9/16

CHECKING POINTS

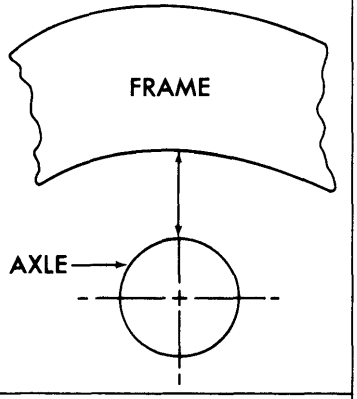
ALL EXCEPT ELDORADO



ELDORADO



ALL



FRONT REAR

(NOTE: On cars equipped with Automatic Level Control, first determine if the unit is working. Place weight of one man on rear bumper. Rear of car should lower and then raise after 4 to 18 seconds. If system is inoperative, see Note 17, Compressor Output Test and Note 18, Control Valve Test.)

*Springs can settle up to 3/8" during first 2500 vehicle miles. The values in this chart are for vehicles with settled springs. On new vehicles, add 3/8" to measurements given.

BACK TO INDEX

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GENERAL DESCRIPTION

(NOTE: The following information is applicable only to the Eldorado.)

A four link, coil spring rear suspension system is used on Eldorado series cars Fig. 4-8. It consists of two upper and lower control arms, coil springs, stabilizer bar, and Automatic Level Control shock absorbers.

Automatic Level Control is provided as standard equipment on the Eldorado and functions the same as on other series cars. The height control valve is located on the right side of the frame cross member above the right upper control arm. Consequently, the right shock absorber has a double port, Fig. 4-17.

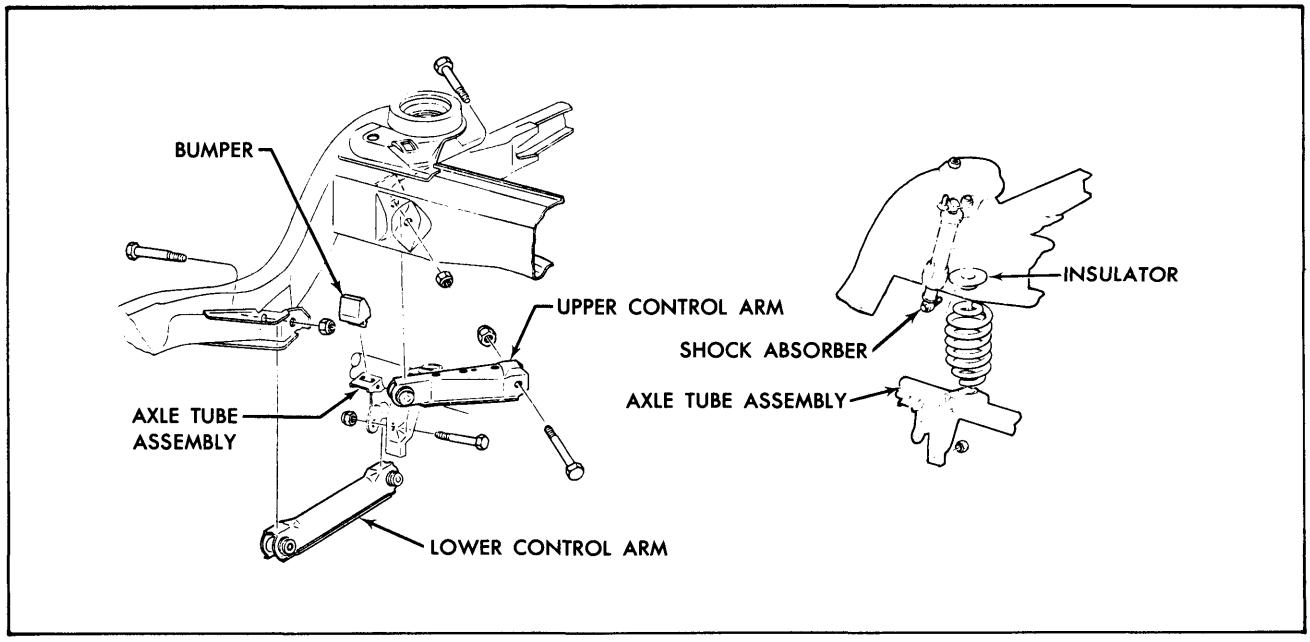


Fig. 4-8 Rear Suspension Disassembled — Eldorado

SERVICE INFORMATION

The service information that follows pertains only to the Eldorado. For service information not given, refer to the forward portion of the appropriate subsection, as the procedures are the same as for other models.

CAUTION: When raising rear of car, support vehicle weight at frame or axle or both. Never use control arms as contact points for hoist or jack stands, as damage may result.

CAUTION: If any mispositioning, incorrect disassembly or assembly, or failure of components in the area of the brake system pipes or hoses is observed, be sure to check for any damage that may have resulted from such a condition and correct as required. Components that could damage the brake system due to mispositioning, incorrect disassembly or assembly, or failure include the exhaust system, shock absorbers, springs, and suspension control arms.

11. Rear Upper Control Arm

a. Removal

1. Raise car on hoist and position jack stands at rear frame side members. Car is now supported at both frame and rear axle.
2. Disconnect Automatic Level Control system overtravel link at right upper control arm axle bracket and place overtravel lever at its centered position.
3. Disconnect shock absorber at its lower mount and position out of way.
4. Raise axle on hoist to relieve tension on upper control arm.
5. Remove bolt and nut securing upper control arm to rear axle bracket.
6. Remove bolt and nut securing upper control arm to frame cross member and remove arm.

b. Installation

1. Install control arm in its mounting brackets.
2. Loosely install bolts and nuts securing control arm in mounting brackets, adjusting height of axle as necessary. (Do not torque bolts at this time.)
3. Guide shock absorber lower stem into lower mount, adjusting height of axle if necessary, and secure with retaining nut. Tighten to 50 foot-pounds.
4. Raise axle and remove jack stands.

(NOTE: When tightening nut and holding bolt, a

BACK TO INDEX

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lower torque is used than when tightening bolt and holding nut.)

5. Torque upper control arm bolts while holding nuts, at frame cross member to 145 foot-pounds and torque upper control arm bolts at axle bracket to 110 foot-pounds.

See CAUTION on Page 4-3.

CAUTION: Pivot bolts in control arms must be torqued when full normal load is on axle. If not, the ride rate may be adversely affected.

6. Secure Automatic Level Control overtravel lever to right upper control arm bracket with nut. Lower car. Inflate reservoir to 140 psi or maximum pressure available through service valve.

7. Inspect brake hose and lines for any damage that may have occurred during this operation, and repair as necessary.

12. Rear Upper Control Arm Bushing

Only the rear upper control arm rear bushings (those pressed into the axle bracket) are serviced separately. All other bushings in the Eldorado rear suspension are serviced only with their respective control arms, as assemblies.

a. Removal

1. Remove rear upper control arm as described in Note 11a, Steps 1 through 6.
2. Move control arm away from bushing.
3. Install tools as shown in Fig. 4-9, and press bushing from axle bracket.

b. Installation

1. Insert bushing into axle bracket with flanged side on outboard side of bracket.
2. Install tools as shown in Fig. 4-10, and press bushing into axle bracket.
3. Install upper control arm as described in Note 11b, Steps 2 through 7.
4. Lower car.

13. Lower Control Arm

a. Removal

1. Raise car on hoist.
2. Remove bolts and nuts securing lower control arm to axle and frame side member brackets and remove control arm.

b. Installation

1. Position lower control arm in frame side member and axle brackets and insert bolts and nuts. Do not torque at this time.
2. Inspect brake lines and hose for any damage that may have occurred during this operation, and repair as required.
3. Lower car.
4. Tighten control arm bolts to 145 foot-pounds while holding nuts stationary.

See CAUTION on Page 4-3.

CAUTION: Pivot bolts in control arms must be torqued when axle is under normal load. If not, the ride rate may be adversely affected.

14. Rear Springs

a. Standing Height

Rear standing heights should be equal within 1/2 inch from side to side (see chart on Page 4-9.) If rear

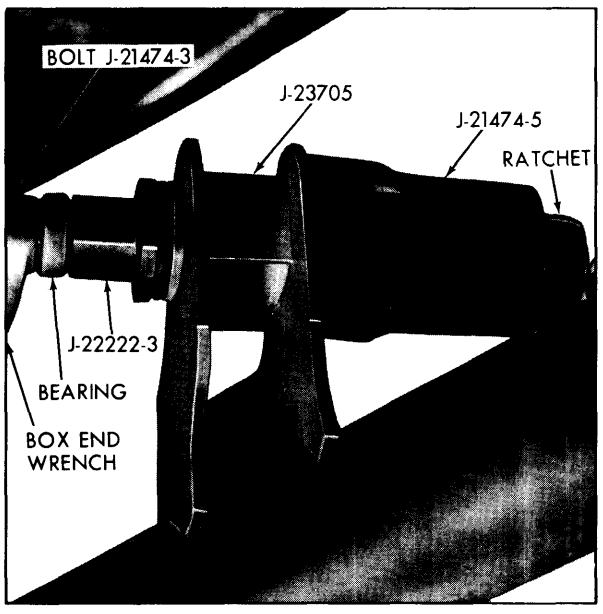


Fig. 4-9 Removing Upper Control Arm Bushing From Axle — Eldorado

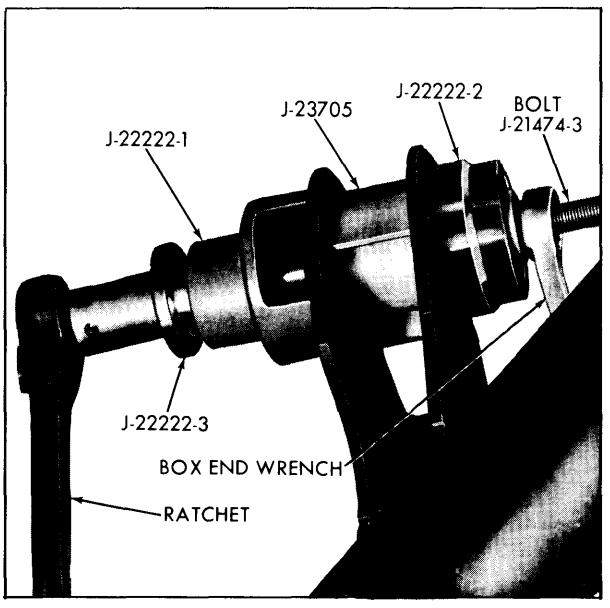


Fig. 4-10 Installing Upper Control Arm Bushing In Axle — Eldorado

BACK TO INDEX

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height is out of specified range, set front standing height to mean specification and recheck rear heights. Spring that checks below specification must be replaced.

b. Removal

1. Perform procedure in Note 11a to remove both rear upper control arms from axle brackets and to remove both shock absorbers from their lower mounts.
2. Disconnect brake hose and cap brake system to minimize leakage.

3. WARNING: IF AXLE IS LOWERED BEYOND FULL REBOUND POSITION, SPRINGS MAY SNAP FROM SPRING SEATS AND CAUSE INJURY OR DAMAGE. FOR THIS REASON, LOWER AXLE TO A POSITION JUST SHORT OF FULL REBOUND, THEN COMPRESS SPRING BY HAND AND REMOVE FROM SPRING SEATS.

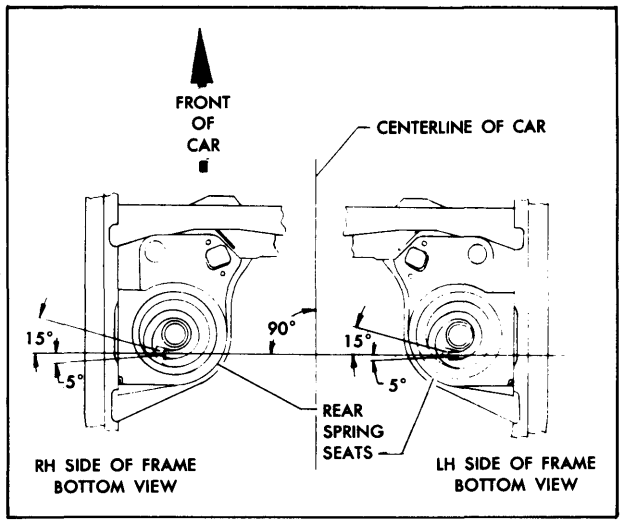


Fig. 4-11 Coil Spring Indexing — Eldorado

Lower axle carefully until springs can be removed manually.

b. Installation

1. Inspect rubber insulator in upper spring mounts for damage and proper position.
2. Insert springs and raise axle until springs are fully seated, and upper end of springs positioned within limits shown in Fig. 4-11.
3. Install upper control arms, shock absorbers, and connect Automatic Level Control, as described in Note 10b, Steps 1 through 6.
4. Connect brake hose and bleed brakes as described in Section 5, Note 6.

15. Rear Wheel Stud Replacement Test-On Car

a. Removal

1. Remove wheel disc and loosen wheel mounting nuts.
2. Raise rear end of car.

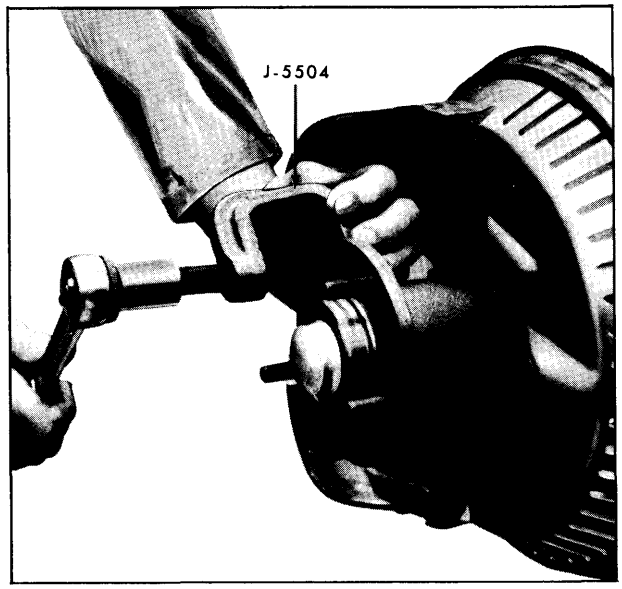


Fig. 4-12 Removing Stud

3. Remove wheel and tire assembly and brake drum.
4. Install tool J-5504 on damaged stud and press stud from hub, Fig. 4-12.

(NOTE: Optional tool J-22292-1 may be used for this application. Either tool must be modified by cutting 1/4" off the end of each leg.)

b. Installation

1. Install a new stud from back side of hub.
2. Install two flat washers on stud and wheel nut, flat side toward washers, and tighten nut with fingers.
3. Torque nut to 140 foot-pounds.
4. Remove nut and washers from stud and discard.
5. Visually check stud threads and stud to make certain they are properly seated on inside of hub.

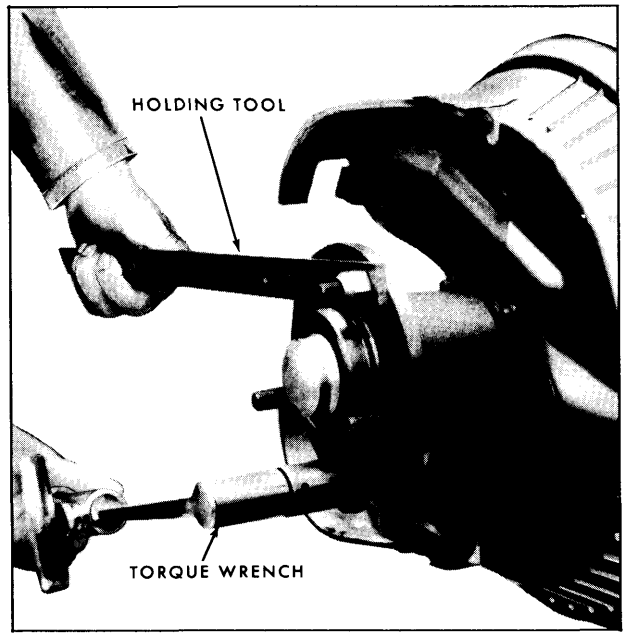


Fig. 4-13 Installing Stud (E-Car Rear)

BACK TO INDEX

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6. Install rear brake drum.
7. Position wheel assembly on hub, installing wheel mounting nuts finger tight.
8. Lower car.
9. Tighten wheel mounting nuts to 130 foot-pounds.
10. Drive car around several blocks making left hand and right hand turns.
11. Re-torque wheel mounting nuts to 130 foot-pounds.
12. Install wheel disc.

See CAUTION on page 4-3.

TORQUE SPECIFICATIONS—ELDORADO

Material No.	Application	Size	Foot-Pounds
300-M	Rear Upper Control Arm Bolts (at axle bracket while holding nuts)	1/2–13	110*
300-M	Rear Upper Control Arm Bolts (at frame cross member while holding nuts)	9/16–12	145*
300-M	Rear Upper Control Arm Nuts (at axle bracket while holding bolts)	1/2–13	80*
300-M	Rear Upper Control Arm Nuts (at frame cross member while holding bolts)	9/16–12	100*
300-M	Rear Lower Control Arm	9/16–12	145*
275-M	Rear Upper Shock Absorber Bolts	5/16–18	12
286-M	Rear Lower Shock Absorber Attaching Nuts	1/2–20	50

**These control arm fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. Each must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure the proper retention of these parts.*

Pivot bolts in control arms must be torqued when axle is under normal load. If not, the ride rate may be adversely affected.

BACK TO INDEX

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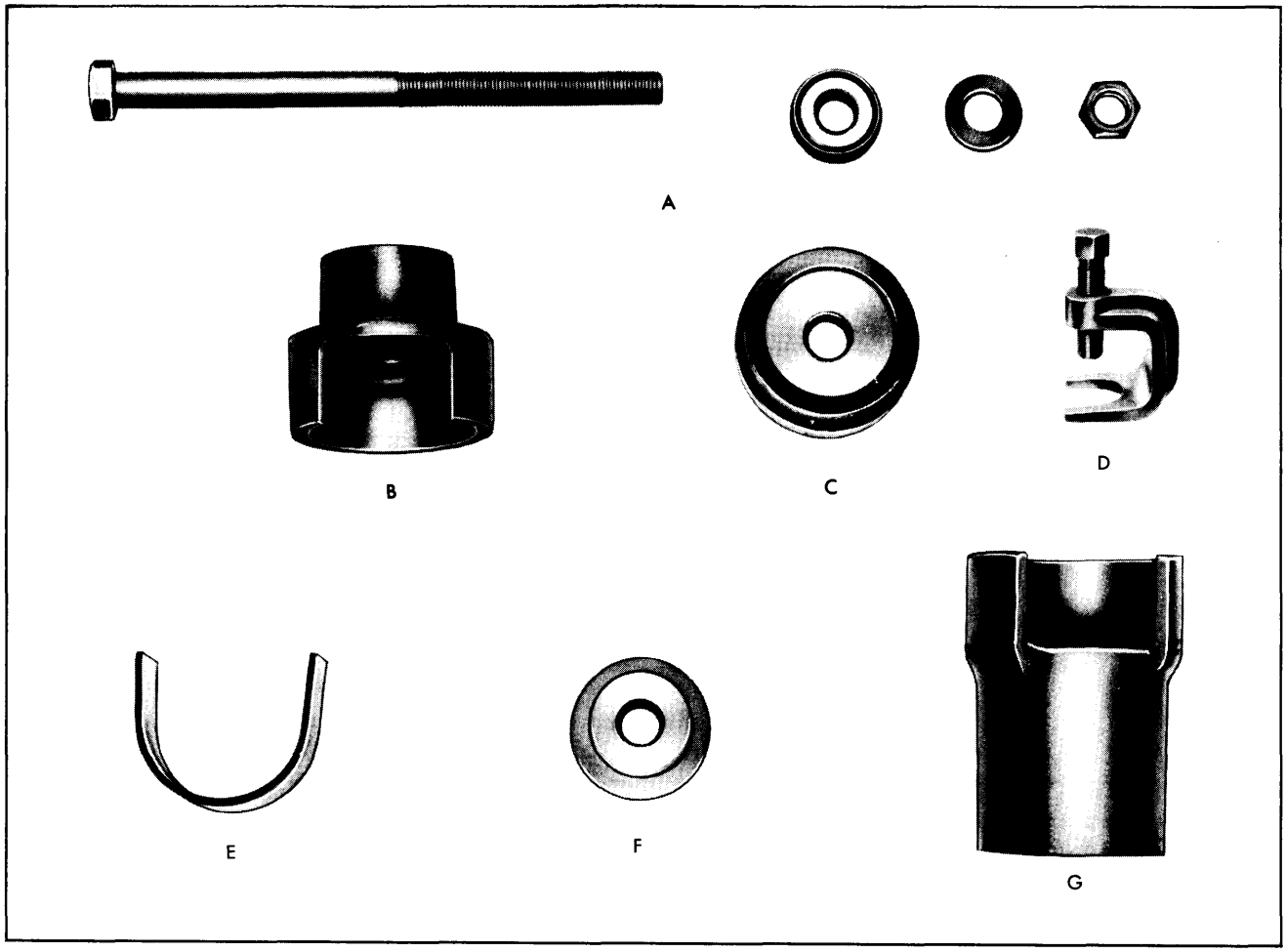


Fig. 4-14 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-21474-3	Driver Bolt Set	E	J-23705	Spacer
B	J-22222-1	Bushing Installer	F	J-22222-3	Pilot
C	J-22222-2	Pilot	G	J-21474-5	Bushing Remover
D	J-5504	Stud Remover			

BACK TO INDEX

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GENERAL DESCRIPTION

System (Fig. 4-12)

Automatic Level Control is provided as standard equipment on the Eldorado, Fleetwood Sixty Special Brougham, and the Fleetwood Seventy-Five Sedan and Limousine, and is optional on all other models. The system consists of an air compressor and tank assembly, pressure regulator, control valve and link, two superlift rear shock absorbers, and flexible air lines (Figs. 4-15, 4-16).

After completion of work on this system, or when servicing other parts of the car requiring system discharge, recharge the reservoir to 140 psi or maximum pressure available, by applying dry air through the compressor service valve located on the pressure regulator.

CAUTION: It is essential that no oil is fed into system. Do not use an air source that utilizes an oil mist for lubrication as it may contaminate the system.

Compressor and Reservoir

The compressor operates on the difference between (1) engine manifold vacuum, supplied to the compressor by a line connected to the crankcase ventilator valve vacuum line, and (2) a higher pressure air at or near atmospheric pressure, available through an air supply line at the air cleaner.

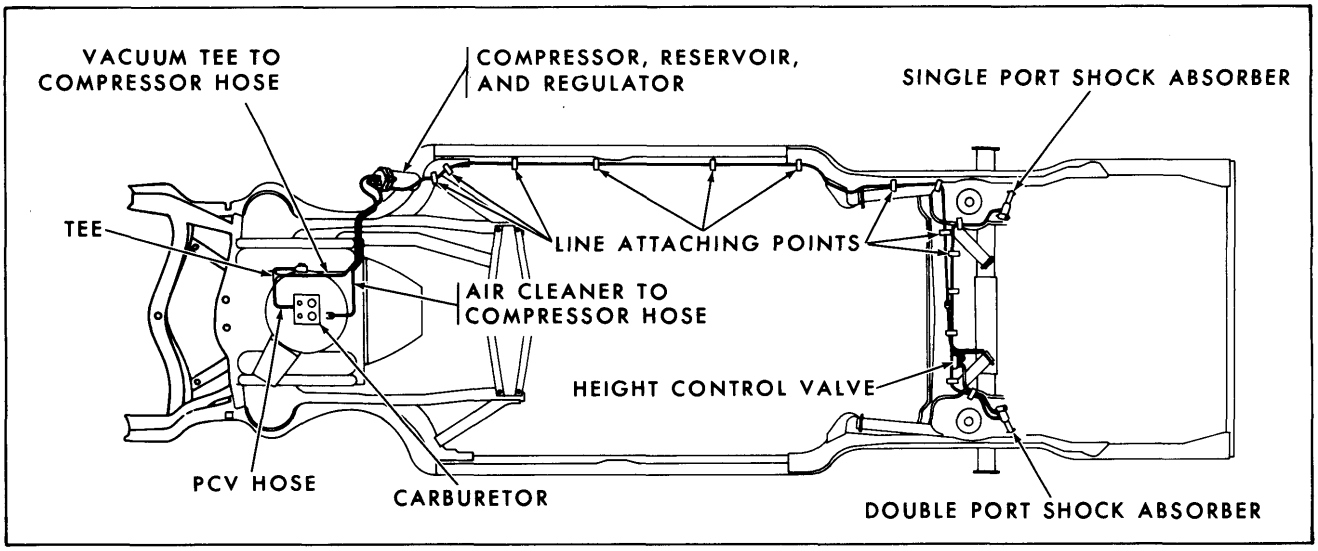


Fig. 4-15 Location of Automatic Level Control Components – Except Eldorado

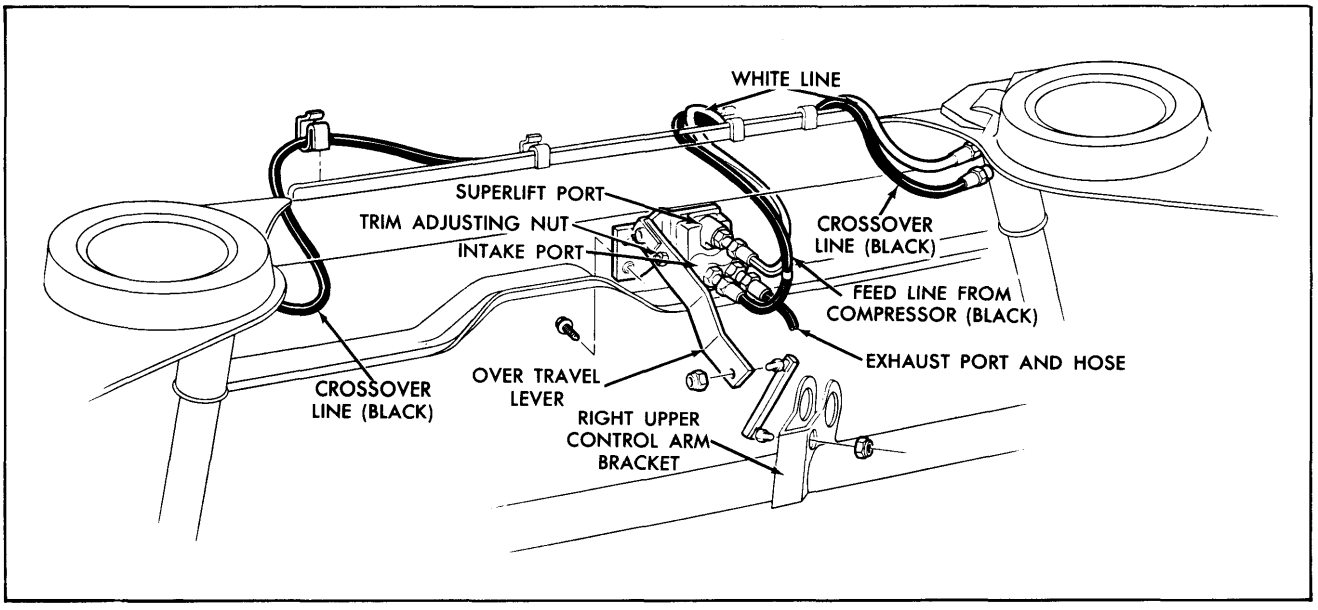


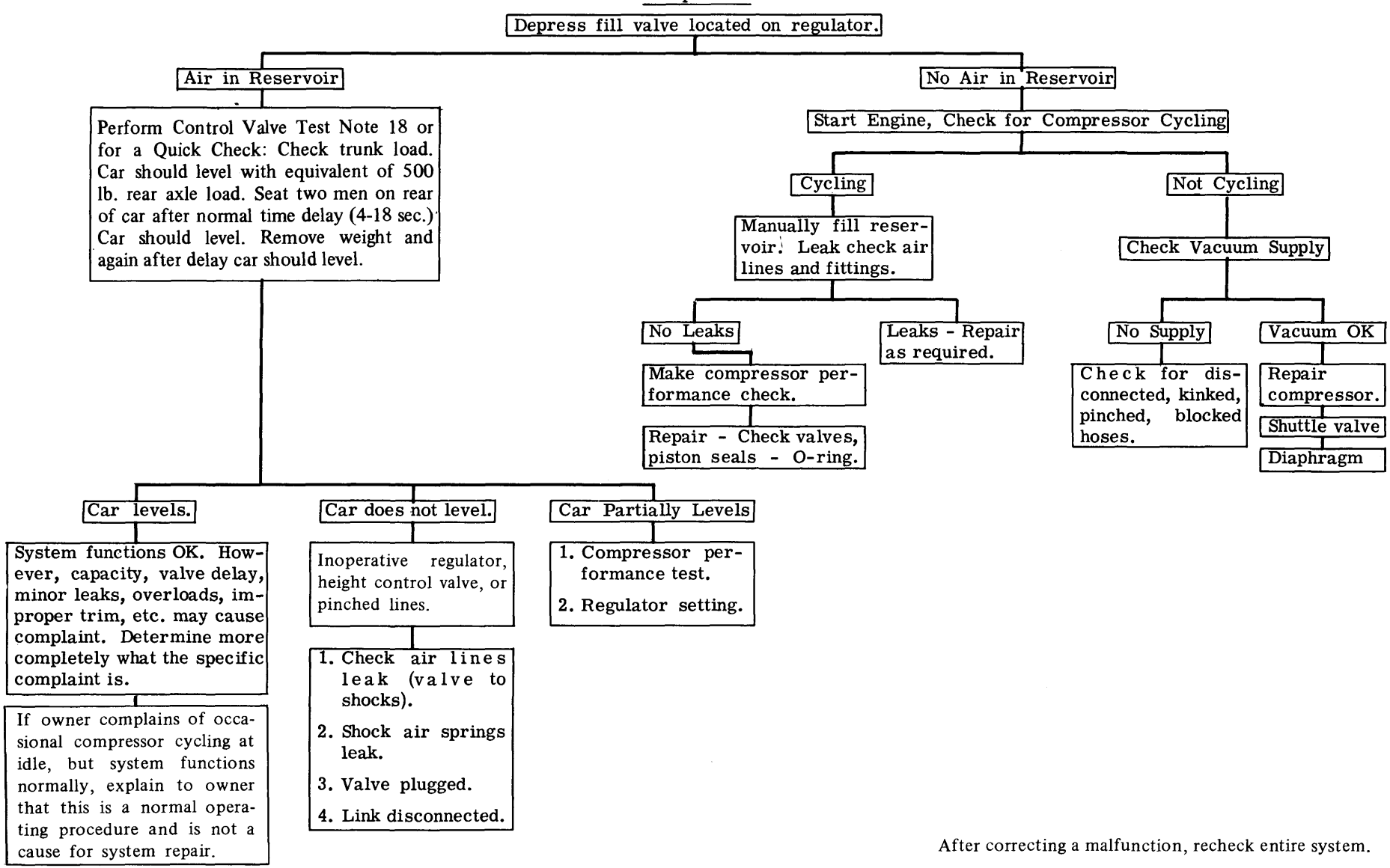
Fig. 4-16 Location of Automatic Level Control Components – Eldorado

BACK TO INDEX

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BACK TO INDEX

DIAGNOSIS CHART
AUTOMATIC LEVEL CONTROL



After correcting a malfunction, recheck entire system.

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Balance pressure will depend upon the prevailing manifold vacuum at the carburetor insulator and prevailing atmospheric pressure. Both are affected by altitude above or below sea level. Balance pressure will vary from approximately 150 psi to 275 psi.

Pressure Regulator

A pressure regulator is attached to the output side of the reservoir. It regulates shock absorber pressure to approximately 125 psi.

Control Valve and Link

The rear standing height is automatically maintained at a nearly constant position by a control valve attached to the rear suspension cross member. A link attaches the valve lever to the axle assembly. On all styles except the Eldorado, the attaching point is on the left upper control arm.

On the Eldorado, the link attaches to the right upper control arm axle bracket; and the right superlift, rather than the left, has a double port, Fig. 4-13.

Superlift Rear Shock Absorber (Fig. 4-14)

The superlift shock absorber, Fig. 4-17, is essentially a conventional shock absorber enclosed in an air chamber. A pliable nylon reinforced neoprene boot seals the dust tube (air dome) to the reservoir tube (air piston). The unit will extend when inflated and retract when deflated by the control valve. The units are connected by a flexible air line which equalizes the air pressure in the two shock absorbers.

Lines and Fittings

Flexible air lines of 1/8 inch diameter tubing are used throughout the system. Each fitting consists of a rubber seal, metal sleeve, and nut. These parts are designed specifically for the 1/8 inch diameter line and must be used to effect a reliable seal.

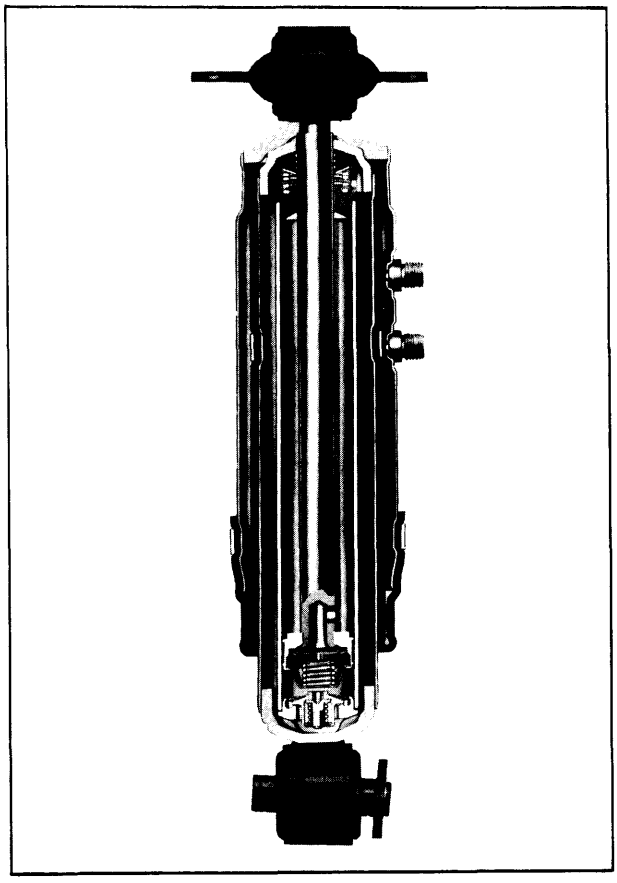


Fig. 4-17 Rear Shock Absorber (Automatic Level Control)

Dealer Installation

As a dealer-installed option, the Automatic Level Control system may be installed either by retaining standard suspension springs or by changing to the optional spring, as the customer desires.

SERVICE INFORMATION

16. Quick Check of Automatic Level Control System

If check is performed when car is cold (15°F or less), time delay may be as much as 30 seconds.

1. Measure rear trim height of empty car (measured from center of rear bumper to ground.)
2. Add weight equivalent to two passenger load to rear of car. Car should begin to level in 4-18 seconds and final position should be within 3/4 inch of dimension measured in Step 1. (If gas tank is nearly empty, a third passenger's weight may be needed.)
3. Remove weight. After 4-18 seconds car should begin to settle. Final unloaded position should be within approximately 1/2 to 3/4 inch of loaded measurement.

17. Compressor Output Test–On Car

1. Remove high pressure line at regulator adapter fitting and connect Test Gage, J-22124, Fig. 4-18.
2. Deflate reservoir to 70 psi through service valve.
3. Observe Test Gage for evidence of compressor air leak.
4. If compressor is leaking, proceed to leak test

BACK TO INDEX

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compressor reservoir and regulator as described in Note 20a. If not leaking, continue this test.

5. With engine running at slow idle and reservoir pressure at 70 psi, observe reservoir build-up for five minutes. Reservoir pressure should build-up to a minimum of 100 psi at 15 inch vacuum. A minimum of 14 inches of vacuum must be available, or test may not be reliable.

6. If compressor fails to cycle, make sure the vacuum and air intake lines are not reversed and are open and unobstructed before removing compressor for repair. Check for pinched or kinked vacuum hoses.

7. If build-up is too slow, and a recheck of vacuum and intake hoses show no restrictions, repair compressor as outlined in Notes 25, 26 and 27.

8. Satisfactory pressure build-up indicates compressor is functioning properly. Continue to build up pressure and perform regulator check as described in Note 18.

9. If no leaks are detected and compressor and regulator functions properly, remove test gage. Install high pressure line and proceed to Control Valve Test, Note 18.

18. Control Valve Test

If tests are performed when car is cold, (15°F or less) time delay may be as much as 30 seconds.

a. Intake – Reservoir Pressure 125 psi Minimum

1. Disconnect overtravel lever from link.
2. Hold lever up in intake position until shock absorbers inflate or for a minimum of 18 seconds.
3. If shock absorbers inflate and hold, proceed to Time Delay Check.
4. If shock absorbers inflate and then leak down, perform leak test on lines and fittings and then on shock absorbers, Note 20d.

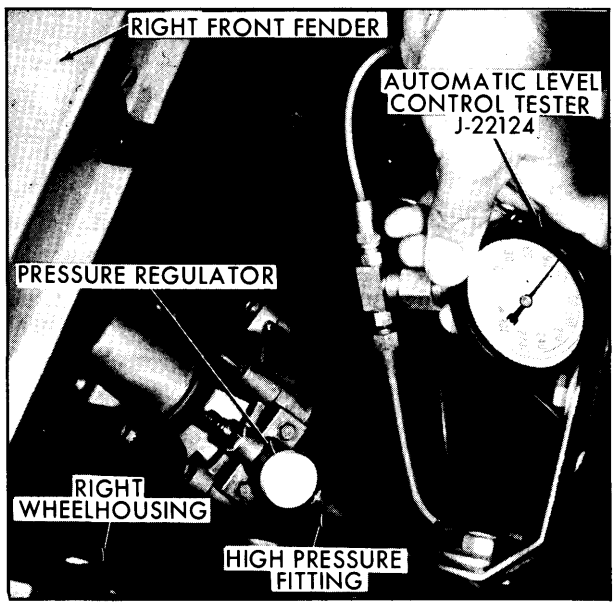


Fig. 4-18 Testing Compressor Output

5. If shock absorbers inflate with the lever in the neutral position, perform leak check on valve.
6. If shock absorbers do not inflate, check air source. Also check and, if necessary, replace intake and shock absorber screens and O-rings, If shock absorbers still do not inflate, perform leak test on valve, Note 20b. Repair as indicated and proceed to time-delay check.

b. Exhaust – Shock Absorbers Inflated

1. Disconnect overtravel lever from link.
2. Hold lever down in exhaust position until shock absorbers deflate or for a minimum of 18 seconds.
3. If shock absorbers deflate, perform Intake Check.
4. If shock absorbers do not deflate, remove exhaust adapter from control valve and hold lever down as in Step 2. Replace adapter, O-ring, and filter if this deflates shock absorbers.
5. If shock absorbers deflate with lever in neutral position, perform leak checks on lines and fittings. If continuous leakage appears at exhaust valve port, check control valve for leaks, Note 20b.
6. Replace control valve if none of the above steps correct the condition.

c. Time Delay Check

1. Disconnect overtravel lever from link.
2. Disconnect lines at shock absorbers and intake ports.
3. Connect Test Gage J-22124, to intake valve port and open air pressure (95 psi). Move overtravel lever approxiately one inch down from neutral position as measured from end of lever, and hold for 15-20 seconds.
4. Quickly move overtravel lever upward two inches and note number of seconds before air starts to escape from shock absorber port. This delay should be from 4-18 seconds. Repeat check. This will check the air intake time delay. Proceed with check to determine air exhaust time delay.
5. Remove Test Gage and plug intake port with Fill Valve, J-21999, (female end).
6. Connect Test Gage to shock absorber port and open air pressure (95 psi). Move overtravel lever approximately one inch up from neutral position as measured from end of lever, and hold for 15-20 seconds.
7. Quickly move overtravel lever downward two inches; at the same time begin timing number of seconds until air begins to escape from exhaust port. This delay should be 4-18 seconds. Repeat check.

If either delay is not within specification, replace the leveling control valve and proceed to Trim Adjustment On Car, Note 21.

19. Regulator Test

Performance test the regulator with a known good compressor on the car.

1. Delfate system through service valve, remove line at regulator and connect Test Gage, J-22124, at regulator adapter.
2. Inflate reservoir through service valve to

BACK TO INDEX

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maximum pressure available. If less than 140 psi, start engine to build up reservoir to this pressure.

3. Regulated pressure on the Test Gage should build up to 100-130 psi and hold steady within this pressure.

4. Recheck regulated pressure by momentarily depressing valve core on Test Gage and observe gage reading.

5. If regulated pressure exceeds 130 psi, replace regulator as a unit.

20. Leak Tests

a. Compressor, Reservoir, and Regulator

1. Remove assembly, Note 24a.

2. Connect Test Gage to regulator. Inflate reservoir through service valve to 80-110 psi.

3. Route an eight inch rubber hose between vacuum and vent ports, Fig. 4-19.

4. While holding assembly in a vertical position with reservoir end down, immerse in water until the diaphragm is just submerged, Fig. 4-19. Do not submerge completely, as water can enter around the cover gasket. Observe for air leaks at:

- Reservoir weld seam.
- Reservoir-to compressor O-ring. A stream of bubbles may appear in this area and then cease. The bubbles are caused by atmospheric air being purged from air pockets in the second stage housing. If the bubbles stop in 20 seconds or less there is no leak.
- Regulator to compressor O-ring.
- Regulator boot - defective internal O-ring.
- Diaphragm between first and second stage housings - tightening through-bolts may correct the leak.
- Service valve.
- Test gage connections.

5. Remove hose from vacuum port and submerge disconnected end in water. Cover vacuum port with finger. Do not permit water to enter through vacuum port. If bubbles are evident, the probable cause is a defective second stage housing check valve.

6. Correct any leaks by either tightening screws or replacing parts.

7. If the cover gasket area is inadvertently submerged, remove cover and tilt unit so that water may drain through openings by distributor valve mechanism. Move distributor valve from side to side until all water is purged. Dry both the distributor valve mechanism and the interior of the cover with compressed air. Replace cover.

If the compressor passes this test, yet fails the output test, overhaul the compressor, reservoir, and regulator assembly.

b. Control Valve

1. Remove control valve from car as described in Note 23a.

2. Clean exterior of control valve thoroughly.

3. Connect Test Gage, J-22124, and air pressure source to intake adapter and open air pressure (80-110 psi).

4. Submerge unit in water. No air should escape if overtravel lever is in "neutral" position. If bubbles escape from shock absorber port, proceed to step 8.

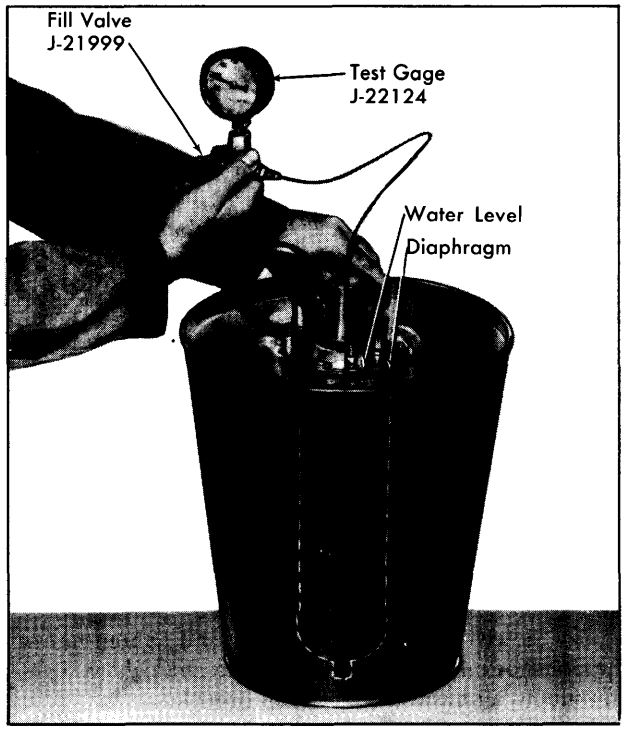


Fig. 4-19 Checking Compressor For Leaks

5. Shut off air pressure and detach test gage from air intake port. Plug intake port with Fill Valve, J-21999, (female end).

6. Connect Test Gage to shock absorber port and open air pressure.

7. With overtravel lever in "neutral" position no air should escape. If bubbles escape from exhaust port, proceed to step 8.

8. If the intake valve or exhaust valve is leaking with the lever in the neutral position, remove the cover plate and clean out the valve body. Blow air through the intake and exhaust valves while actuating the valves with the lever arm, do not remove the valve cores as they are selected and calibrated in each valve.

9. Install gasket and cover plate and check for leaks. If the valve cores still leak, replace the control valve.

c. Lines and Fittings

1. Disconnect overtravel lever from link.

2. Hold lever up in intake position for maximum shock absorber inflation and release.

3. Leak check all connections, with a soap and water solution. Leak test solution may also be used.

d. Shock Absorbers

1. Disconnect lines and remove shock absorber from car as described in Note 2a.

2. Inflate individually to 50-60 psi, utilizing Fill Valves, J-21999. Submerge in water and observe for leaks.

3. Install shock absorbers as described in Note 2b.

BACK TO INDEX

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21. Trim Adjustment—On Car

Trim adjustment should be performed with a full fuel tank (or the equivalent in load at the rate of 6 lbs/gallon).

a. Preparation

1. Raise car with rear axle supported.
2. Remove shock absorber line at control valve.
3. Connect a Fill Valve Assembly, J-21999, to this line (male end).
4. Inflate shock absorbers to 8-15 psi. Move car up and down to neutralize suspension.
5. Connect Test Gage, J-22124, to shock absorber adapter on control valve and attach air pressure source (80-110 psi).

b. Adjustment

1. Loosen overtravel lever adjusting nut.
2. Hold overtravel body down in exhaust position until air escapes from exhaust valve port.
3. Slowly move overtravel body and tighten nut at the point of minimum air bleed. With nut tight, a slight continuous air bleed will still be noticeable.

c. Restore System

1. Remove Test Gage and air pressure source from shock absorber adapter.
2. Remove Fill Valve Assembly, J-21999, from shock absorber line and reconnect line to control valve.
3. Lower car and inflate reservoir through service valve.

22. Tubing (Fig. 4-17)

(NOTE: Tubing may be removed by simply unscrewing nut. Be sure system is deflated when separating air lines. When installing tubing at any Automatic Level Control fitting, be careful not to kink line.)

1. Preassemble metal sleeve and rubber seal, Fig. 4-20.
2. Place nut on tubing.
3. Insert tube into metal sleeve and rubber seal until tube bottoms.

(NOTE: Be careful not to extend tubing completely through rubber seal.)

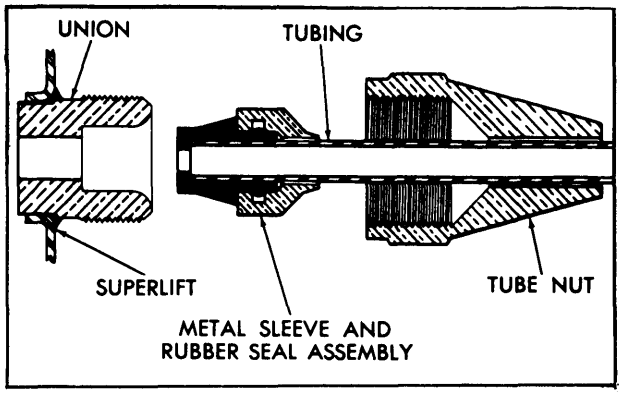


Fig. 4-20 Typical Tubing Fitting

4. Holding tubing in bottomed position, tighten tube nut securely (30-40 inch pounds).

(NOTE: Tubing may be reinstalled at its connections. If tubing is cracked at end, it will be necessary to cut flush and use a new metal sleeve and rubber seal to assemble connector. Be careful not to remove too much, or tubing may be kinked or broken at full suspension travel. Care should be taken that proper routing is followed in areas close to the exhaust system to prevent burning the tubing. Note particularly the areas at rear suspension cross member.)

23. Height Control Valve

a. Removal

1. Deflate system, using service valve.
2. Disconnect air lines at leveling valve intake and shock absorber ports.
3. Disconnect link from overtravel lever by removing nut.
4. Remove two screws securing leveling valve to frame and remove leveling valve.

b. Installation

1. Install leveling valve with two screws, with time delay mechanism down.
2. Secure link to overtravel lever with retaining nut.

(NOTE: If working on limousine, use lower hole in overtravel lever.)

3. Connect air lines at control valve intake and at shock absorber port, assembling tubing as described in Note 21.

(NOTE: Line from upper port of control valve to double port shock absorber is white. This white line can be connected to either upper or lower port of shock absorber.)

4. Inflate reservoir to 140 psi or maximum pressure available through service valve.

24. Compressor, Regulator, and Reservoir Assembly

a. Removal

1. Raise hood and deflate system.

(NOTE: Compressor is on rear of right wheelhousing).

2. Remove air intake and vacuum hoses from compressor fittings.
3. Remove high pressure line from regulator fitting.
4. Remove three screws securing compressor to rear of right wheelhousing, screws are accessible inside wheelhousing.
5. Remove compressor and brackets from wheelhousing.
6. Remove nuts and lockwashers securing mounting brackets to flexible mounts on compressor assembly and remove mounting brackets.

BACK TO INDEX

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b. Installation

1. Position mounting brackets to flexible mounts and secure with lockwashers and nuts.
2. Position mounting brackets to right wheelhousing with compressor end of assembly facing up.
3. Install three screws securing compressor to wheelhousing.
4. Install high pressure line on regulator fitting, following procedure described in Note 22.
5. Install air inlet hose (yellow striped) to vent fitting, Fig. 4-21.
6. Install vacuum hose (black) to vacuum fitting.
7. Inflate reservoir to 140 psi or maximum pressure available through service valve.
8. Lower hood.

25. Disassembling Compressor, Reservoir, and Regulator into Major Components (Fig. 4-22)

The compressor is a precision-built mechanism. All parts should be carefully handled and assembled. Take care to prevent entrance of dirt or foreign matter. DO NOT LUBRICATE as unit is designed to run dry.

1. Remove compressor as described in Note 24a.
2. Remove two flexible mounts and two adapters.
3. Remove reservoir retaining through bolt, cover retaining screw, and cover gasket that secure cover and gasket to first stage housing. Remove cover and discard gasket, if necessary.
4. Remove two regulator retaining screws, regulator assembly, and O-ring from second stage housing. Discard O-ring, if necessary.
5. Remove three nuts at reservoir flange and two through bolts that enter from flanged side of reservoir. Separate reservoir and O-ring. Discard O-ring, if necessary.
6. Remove three compressor retaining through bolts that secure second stage housing to first stage housing.
7. Slide second stage (small diameter) housing straight off piston.
8. Disconnect arm tension spring from swivel arm.
9. Remove air pivot screw and actuating arm.
10. Slide piston assembly straight out of first stage housing.

26. Compressor, Reservoir, and Regulator; Disassembly, Inspection, and Assembly of Major Components

a. Diaphragm

Inspection

1. Inspect diaphragm for holes, looseness, or other defects and replace as necessary.

Disassembly

1. Remove diaphragm retainer with snap ring pliers.
2. Remove diaphragm plate, diaphragm, second diaphragm plate, and washer from piston.

Assembly

1. Install new washer, old plate, new diaphragm

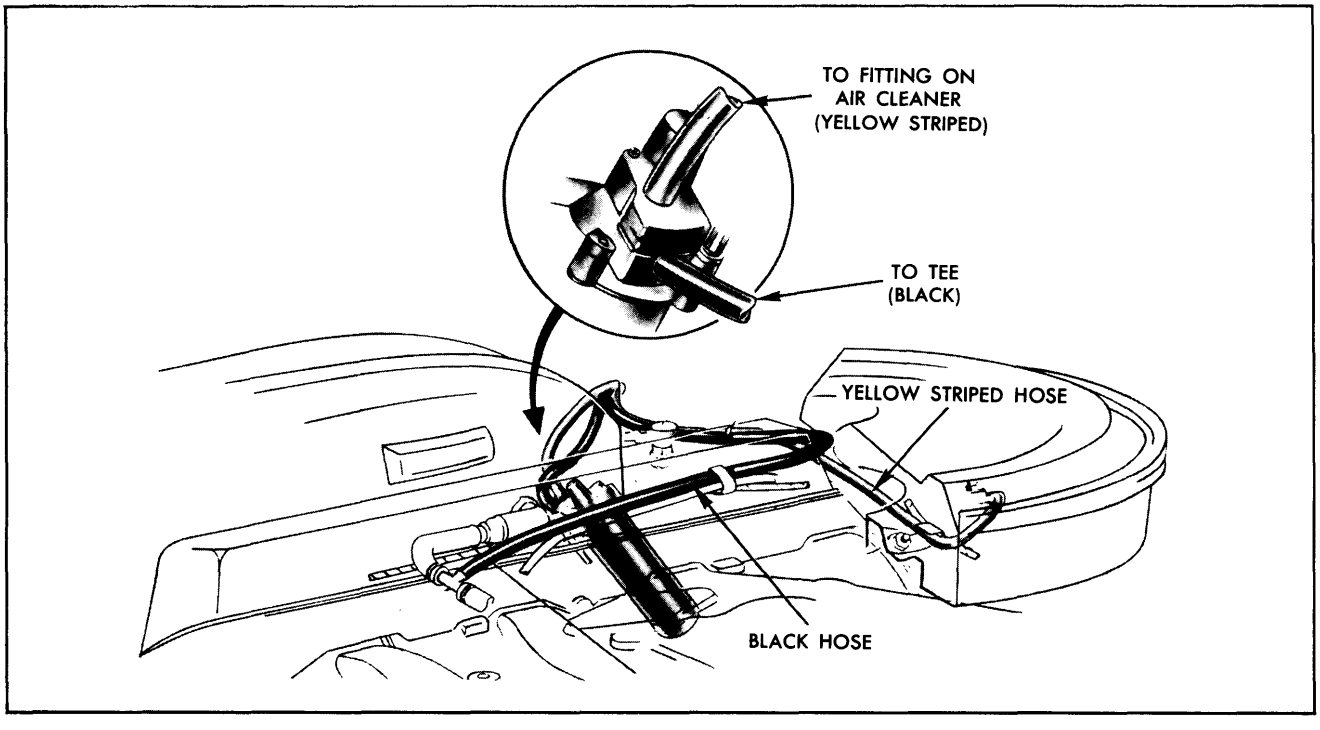


Fig. 4-21 Automatic Level Control Compressor Hose Connections

BACK TO INDEX

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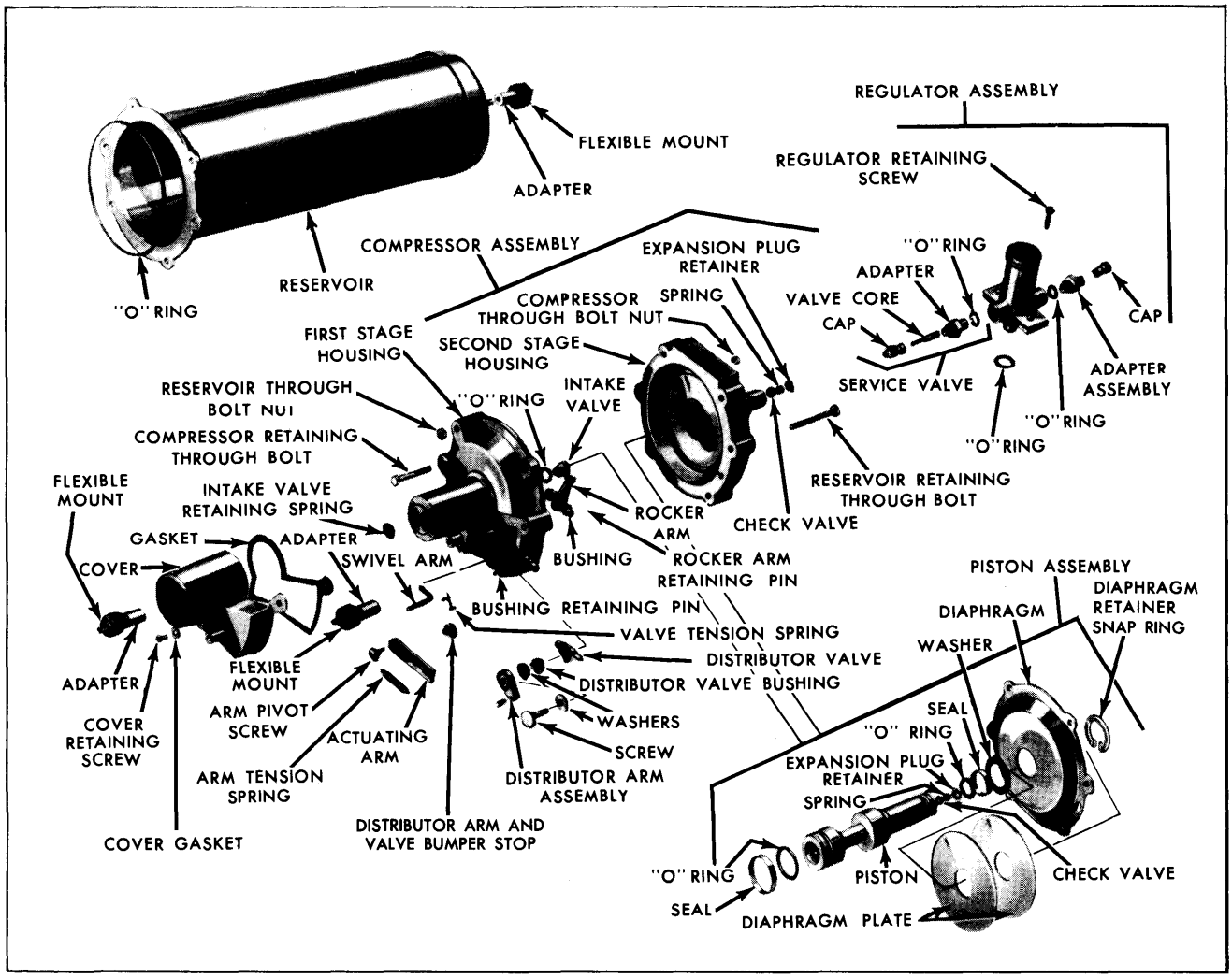


Fig. 4-22 Compressor Assembly Disassembled

with outer lip toward second stage side, Fig. 4-22, and second plate. Plates should be installed so that lips on plates face outboard from diaphragm.

2. Install diaphragm retainer snap ring on groove in piston, Fig. 4-23.

b. Piston Seals

Inspection

1. Inspect seals for evidence of excessive wear or scoring. If necessary, replace seals and O-rings.

Removal

1. Remove seals and O-rings from piston.

Installation

1. Install new O-rings by rolling into groove. Relieve any resulting twist.

2. Install new seals using a piece of .020" shim stock, Fig. 4-24. Make sure shim stock has no sharp edges that may cut seal. Do not stretch seal more than necessary to install. Seals should be installed so they are not twisted.

c. Distributor Valve Mechanism and Intake Valve — First Stage Housing

(NOTE: Actuate distributor valve with finger. Valve tension spring should press against distributor valve, holding it against either stop. If valve action is not free and positive, it will be necessary to rebuild, using new parts in distributor valve and arm package. If action is free and positive, and inspection upon disassembly shows no damaged parts, parts may be re-used.)

Disassembly

1. Remove screw, washer, distributor arm assembly, washer, and distributor valve bushing.

2. Remove two distributor valve and arm assembly bumper stops.

3. Remove distributor valve, being careful not to distort valve tension spring.

4. Remove distributor valve tension spring from first stage housing boss, again being careful not to distort valve tension spring.

5. Remove intake valve retaining spring, intake valve, and washer, using pocket knife.

6. If necessary, remove rocker and swivel arms.

BACK TO INDEX

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Grip pin with water pump pliers and remove pin. Remove swivel arm, rocker arm, and bushings.

Cleaning and Inspection

1. Clean all parts in clean solvent except distributor arm assembly and blow dry with compressed air.
2. Inspect distributor valve for cracks. Discard if damaged.
3. Inspect all other parts for wear or damage.

Assembly

1. If removed, position bushings in first stage housing and install rocker arm and swivel arm. Align hole in rocker arm with swivel arm and install rocker arm retaining pin, small end first. Check for clearance of pin to housing.

(NOTE: If distributor mechanism failed to function properly or one or more parts were found defective, use new parts in distributor valve and arm package during remaining build-up.)

2. Install washer on intake valve and install in first stage housing with intake valve retaining spring. Check for proper seating of valve by blowing air from piston side. No air should pass through valve.
3. Install longer leg of valve tension spring into boss on first stage housing, being careful not to distort valve tension spring.
4. Position distributor valve, being careful not to distort valve tension spring.
5. Install two distributor valve and arm assembly bumper stops.
6. Install distributor valve bushing, washer, distributor arm assembly, and washer and secure with screw. Tighten to 12 inch-pounds.

(NOTE: Do not install remaining parts at this time as rocker arm must be free to permit entrance of piston into first stage housing.)

d. Check Valve Replacement (Second Stage Piston)

1. Pry out expansion plug retainer on second stage piston, with pointed tool and remove spring and check valve.

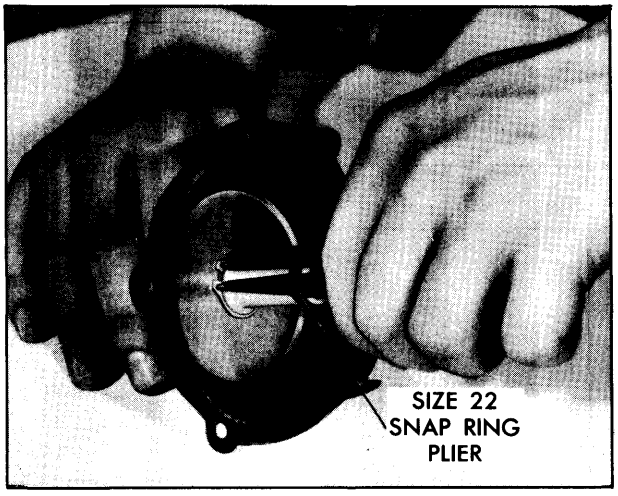


Fig. 4-23 Removing and Installing Snap Ring

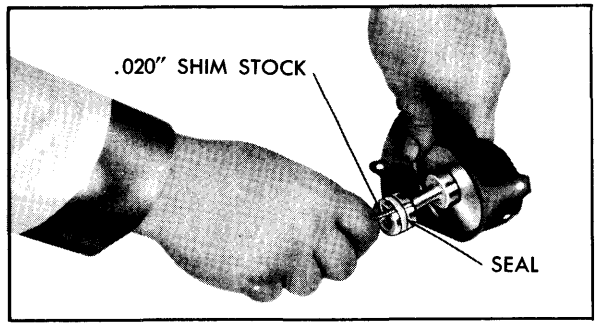


Fig. 4-24 Installing Seal

2. Pour a small amount of clean solvent through bore in piston and blow dry with compressed air. Check valve seat should be smooth and clean.
3. Install new check valve and spring.
4. Insert new expansion plug retainer and tap in until it bottoms.

(NOTE: Check for proper seating of valve by blowing through small end of piston. No air should pass through.)

e. Check Valve Replacement (Second Stage Housing)

1. Pry out expansion plug retainer on second stage housing with pointed tool and remove spring and check valve.
2. Clean second stage housing with clean solvent and blow dry with compressed air. Check valve seat should be smooth and clean.
3. Install new check valve and spring.
4. Insert new expansion plug retainer and tap in until it bottoms.

(NOTE: Check for proper seating of valve by blowing through small end. No air should pass through.)

27. Assembling Compressor, Reservoir, and Regulator from Major Components

1. Slide piston assembly straight into first stage (large diameter) housing.
2. Install actuating arm and attach to first stage housing with arm pivot screw.
3. Connect arm tension spring to swivel arm.
4. Rotate piston in first stage housing to align elongated hole in diaphragm with vent port in first stage housing.
5. Install three compressor retaining through bolts that secure second stage housing to first stage housing. Housings will align one way only. Nuts are positioned in counterbores in second stage housing. Tighten to 28 inch-pounds. Check for free operation of valve parts.
6. Install new O-ring on second stage housing. Wash inside of reservoir in clean solvent and blow dry with compressed air. Install reservoir on second stage housing with three nuts, tightening to 28 inch-pounds. Install two reservoir retaining through bolts, tightening to 28

BACK TO INDEX

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inch-pounds. Through bolt heads should be positioned against reservoir. Do not install through bolt that secures cover at this time.

7. Install new O-ring on regulator and secure regulator with two regulator retaining screws Tighten to 35 inch-pounds. Service valve should be on same side as first stage housing.

8. Install new gasket and cover, and secure with cover retaining screw and new cover gasket. Tighten cover retaining screw to 35 inch-pounds. Install through bolt with head positioned against reservoir. Tighten through bolt to 28 inch-pounds.

9. Install two adapter and flexible mounts.

10. Proceed to compressor output test on car, Note 17.

11. If compressor passes output test, install as outlined in Note 24b.

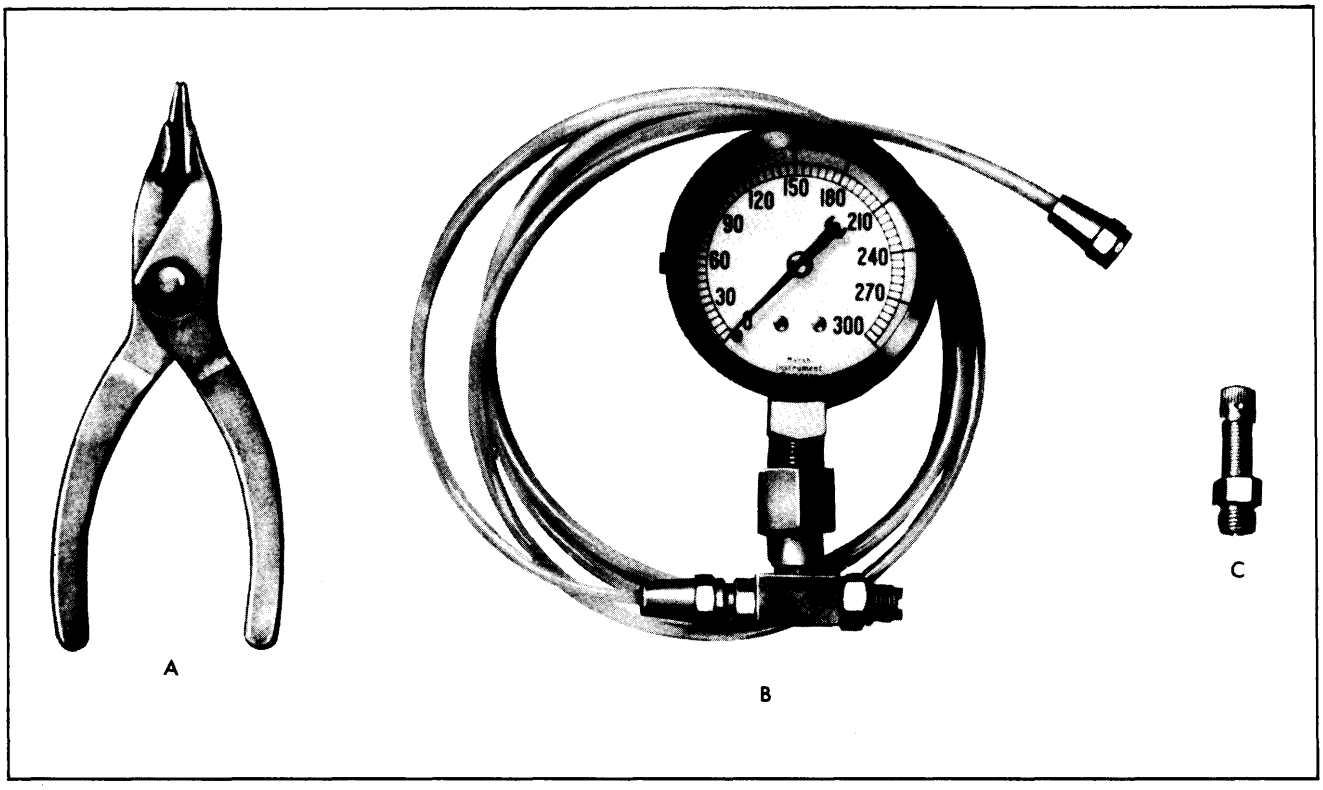


Fig. 4-25 Special Tools

Key	Tool No.	Name
A	J-4880	#22 Snap Ring Pliers
B	J-22124	Test Gage
C	J-21999	Fill Valve

BACK TO INDEX

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GENERAL DESCRIPTION

Propeller Shaft—Except Seventy-Five and Commercial

A one-piece propeller shaft assembly, Fig. 4-26, is used on all styles except the Fleetwood Seventy-Five Sedan and Limousine and the Commercial Chassis. A longer one-piece shaft is used on the Fleetwood Sixty Special Brougham due to the longer wheel base on this body style.

Double Cardan constant velocity universal joints, Fig. 4-27, are used on both the front and rear of the shaft. A Double Cardan joint consists of two single joints connected by a special link yoke. A ball and socket centering device is located between the crosses to maintain their relative positions, causing each cross to operate through one half of the total angle across the joint.

Any time a constant velocity joint is disassembled,

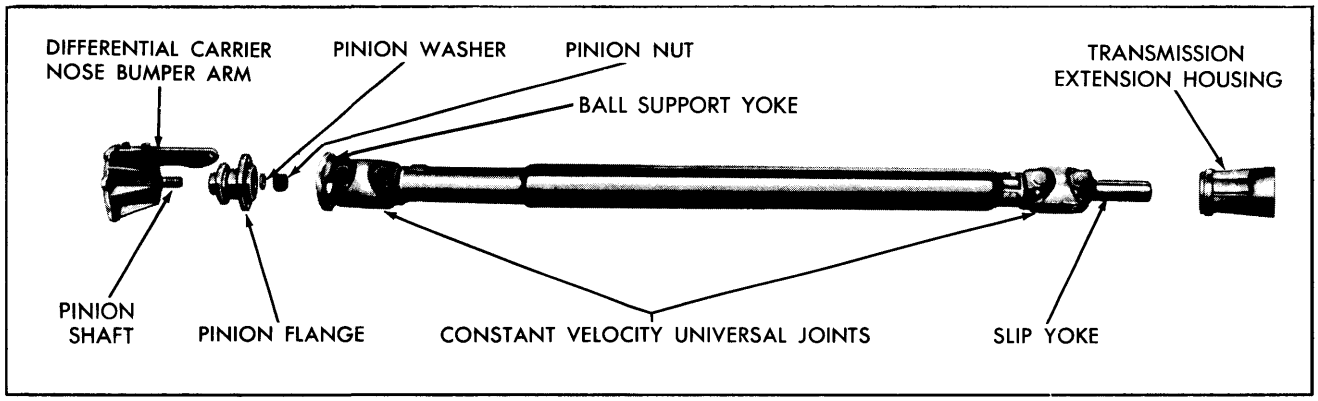


Fig. 4-26 Propeller Shaft Except "75" and Commerical

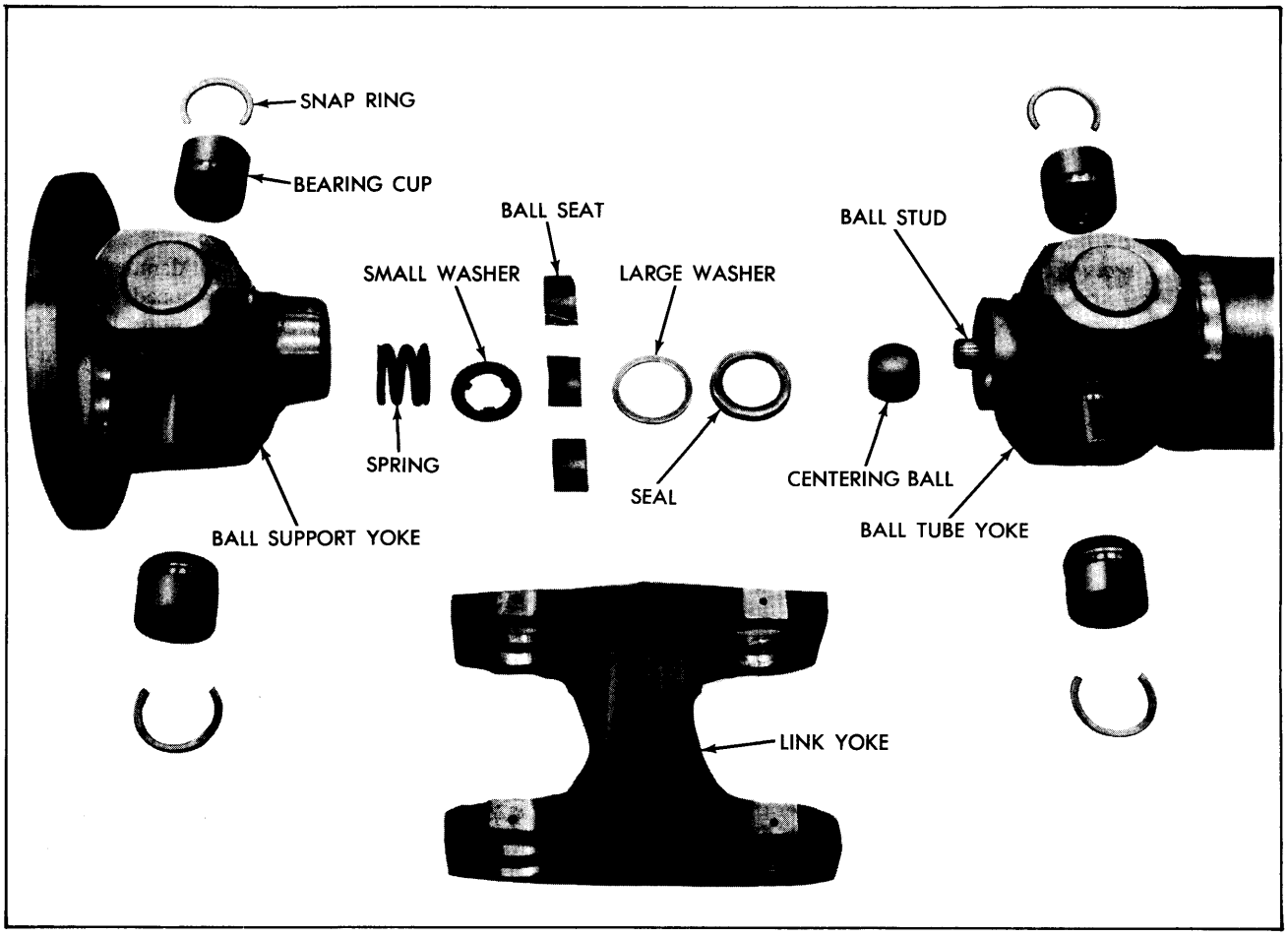


Fig. 4-27 Rear Double Cardan Joint

BACK TO INDEX

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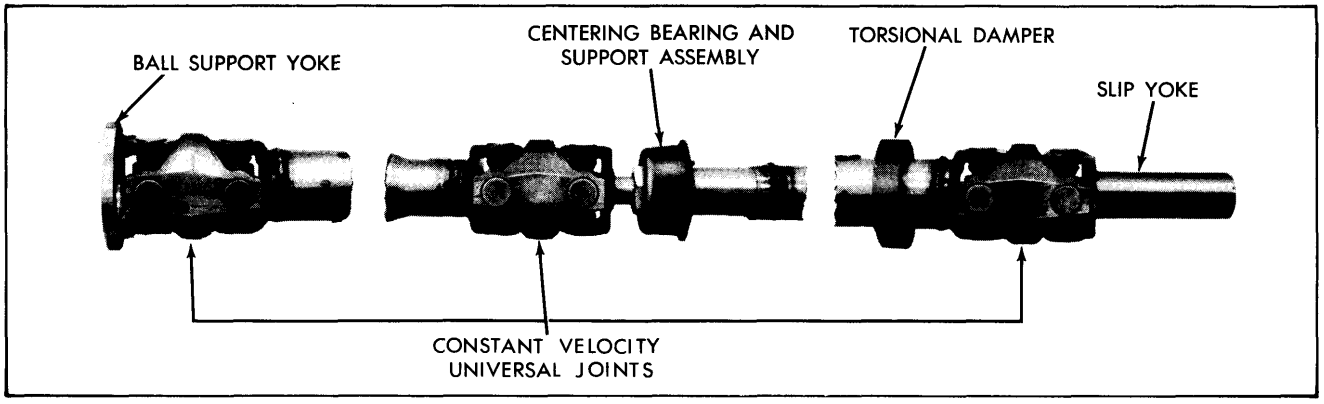


Fig. 4-28 Propeller Shaft "75" and Commercial

inspect the centering ball for corrosion, distortion or wear before continuing procedure. A new replaceable centering ball is used, avoiding the need to replace the entire shaft if such wear exists. A replacement ball seat kit must be installed in the corresponding yoke whenever a centering ball is replaced.

Propeller Shaft—Seventy-Five and Commercial

A two-piece propeller shaft assembly, Fig. 4-28, is used on the Fleetwood Seventy-Five Sedan, Limousine and the Commercial Chassis. Attachments at the transmission output shaft and differential carrier are identical to those of the single piece shaft. Double Cardan joints are located at each end and in the center of the propeller shaft assembly.

The assembly is supported at the center by a center bearing and support and bracket assembly attached to a frame cross member.

As on the one-piece shaft, components that can be serviced separately from the tube include the centering ball, ball seat assembly, bearing cups, crosses, link yokes, slip yoke, ball support yoke and the torsional damper.

In addition, the center bearing and the center bearing support assembly are serviceable.

SERVICE INFORMATION

CAUTION: If any mispositioning, incorrect assembly, or failure of components in the area of the brake system pipes, hoses, or cylinders is observed, be sure to check for any brake damage that may have resulted from such a condition and correct as required. Components that could damage the brake system due to mispositioning, incorrect assembly, or failure include the exhaust system, shock absorbers, springs, suspension control arms, and transmission cooler pipes.

CAUTION: When raising rear of car, support vehicle weight at frame or axle or both. Never use control arms as contact points for hoist or jack stands, as damage may result.

28. Propeller Shaft Rebalancing—On Car

1. Road test car (with owner if possible) to determine nature and speed ranges of complaint.
2. Raise car so that rear axle housing is supported and remove rear wheel and tire assemblies.
3. If car was not road tested, start engine, engage transmission and run speedometer slowly from 0-80 MPH. Note speeds at which roughness is closest to owner's complaint.

(NOTE: Disturbance due to propeller shaft unbalance on Calais, DeVille and Brougham series is most likely to occur at 30-35 MPH or at freeway speeds (approximately 60 MPH). On Seventy-Five and commercial styles, unbalance is likely to peak at 24-28 MPH or 32-35 MPH.)

4. If car is equipped with torsional damper, remove damper and re-evaluate at offending speed ranges. If there is no difference with damper removed, on "C" cars, it is not necessary to reinstall damper unless car is used for trailer towing.

(NOTE: Torsional damper must be reinstalled on Seventy-Five and Commercial series cars.)

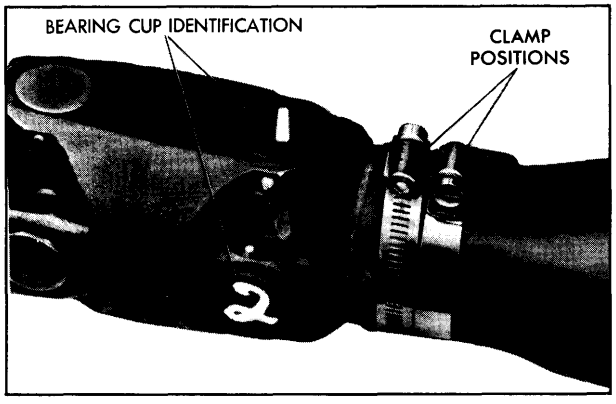


Fig. 4-29 Clamps In Position 1

BACK TO INDEX

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5. If the location of disturbance is not easily found, use the following rule of thumb:

(a) Series Calais, DeVille and Brougham, test front CV joint first.

(b) Series Seventy-Five and Commercial, if greatest disturbance is 20-30 MPH, begin at center joint, then front joint and finally rear joint if necessary. Otherwise, begin at front CV joint.

6. At the suspected unbalanced end of shaft, number the CV joint bearing cups from 1 through 4. See Fig. 4-29.

7. Install two aircraft type hose clamps (size 40 or 44) on swedged down portion of shaft so both clamp screws are aligned with position #1 on the first joint to be checked, Fig. 4-29.

EVALUATION CHART

CLAMP POSITIONS		#1	#2	#3	#4
FRONT CV JOINT	Two Clamps				
	Three Clamps				
REAR CV JOINT	Two Clamps				
	Three Clamps				

W - Worse
N - No Change
I - Improved Slightly
S - Substantial Improvement
A - Acceptable

8. Run rear wheels to speed of distrubance and evaluate. Indicate test results on evaluation chart as shown above.

9. Rotate clamps to position 2 and repeat Step 8. Continue test until all four positions have been checked.

If improvement is found at any location, add another clamp and check for further improvement. Do not add more than five clamps in this manner.

If more weight is required to balance joint, propeller shaft should be removed from car and sent to an approved machine shop for rebalance.

If no improvement is found at any of the four positions, proceed to next joint and repeat Steps 6 through 8 of this procedure.

10. When best possible improvement is achieved, road test car. Often roughness noticeable on hoist will disappear when car is driven on road.

11. Make sure clamps are tight and have sufficient clearance to underbody under all operating conditions. Clamps are to be left on car as permanent fixture.

12. Lower car to floor.

29. Propeller Shaft Assembly—Except Seventy-Five and Commercial

a. Removal

1. Raise car on hoist with transmission in neutral. Mark shaft relationship to axle pinion flange.

2. Remove two accessible ball support yoke attach-

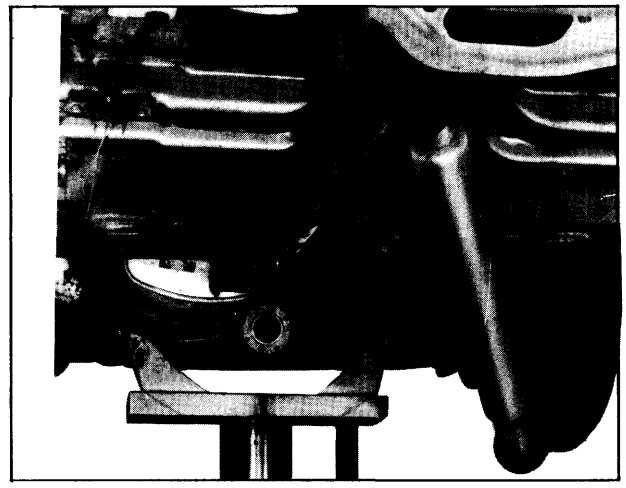


Fig. 4-30 Supporting Propeller Shaft

CAUTION: Do not permit propeller shaft to be supported by the front universal joint only, as damage may result. Rear of propeller shaft must be supported to underbody. A fan belt or piece of wire may be used, Fig. 4-30.

3. Rotate propeller shaft and remove two remaining screws.

(NOTE: Have container ready to catch fluid which may leak from transmission when slip yoke is removed.)

4. Remove propeller shaft by pushing shaft forward to clear pinion flange, then pull shaft rearward to disengage slip yoke.

5. Install a clean cardboard shipping cover or similar device on slip yoke, to protect it from damage.

6. Install spare slip yoke into transmission extension housing to prevent loss of fluid and entrance of dirt.

b. Installation

1. Remove any nicks, burrs, dirt or rust from differential pinion flange face and from face of mating flange of ball support yoke.

2. Remove cardboard cover and clean slip yoke if necessary, avoiding the use of anything that may scratch or damage yoke. Lubricate I.D. of slip yoke with approximately two tablespoons of propeller shaft slip yoke lubricant, Part No. 105 0169, or equivalent and lubricate O.D. with transmisssion fluid.

3. Remove spare yoke previously installed in transmission extension housing, and pack slip yoke lubricant between lips of transmission extension housing seal. Install slip yoke on transmission output shaft.

4. Position ball support yoke flange to pinion flange as marked upon removal and install two screws. Torque screws to 70 foot-pounds.

See CAUTION on Page 4-3.

CAUTION: Engage emergency brake or service brake to hold propeller shaft when tightening flange attaching screws. Do not use a pry bar or heavy tool as universal joint bearing seals could be damaged.

BACK TO INDEX

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5. Rotate propeller shaft to gain access to two remaining screw holes.

6. Install remaining two attaching screws. Torque screws to 70 foot-pounds.

See CAUTION on Page 4-3.

7. Lower car and check transmission fluid level as described in Section 7, Note 6.

30. Propeller Shaft Assembly—Seventy-Five and Commercial

a. Removal

1. Raise car on hoist with transmission in neutral. Mark shaft relationship to axle pinion flange.

2. Remove two accessible ball support yoke attaching screws.

CAUTION: Do not permit propeller shaft to be supported by the front or center universal joint only, as damage may result. Rear of propeller shaft must be supported to underbody. A fan belt or piece of wire may be used, Fig. 4-30.

3. Rotate propeller shaft and remove two remaining screws.

4. Pull rear half of shaft forward to clear pinion flange and support rear end of shaft.

5. Remove the two center bearing support to frame bolts and nuts.

(NOTE: Have container ready to catch fluid which may leak from transmission when slip yoke is removed.)

6. Slide propeller shaft rearward until slip yoke comes off of transmission output shaft and install cardboard shipping cover, or similar protective device on slip yoke. The cardboard cover will prevent nicking of the yoke during removal as well as keeping the yoke as clean as possible.

7. On Seventy-Five series cars, lower propeller shaft from chassis. On Commercial series, withdraw propeller shaft through frame cross member, removing it from the rear.

8. Install a spare yoke into transmission extension housing to prevent loss of fluid and entrance of dirt.

b. Installation

1. Remove any nicks, burrs, dirt, or rust from differential pinion flange face and from face of mating flange of ball support yoke.

2. Remove cardboard cover and clean slip yoke, if necessary, avoiding the use of anything that may scratch or damage yoke. Lubricate I.D. of slip yoke with approximately two tablespoons of propeller shaft slip yoke lubricant, Part No. 105 0169 or equivalent.

3. On Commercial series cars, perform the following procedure:

a. Replace cardboard cover on yoke.

b. Slide propeller shaft assembly through frame cross member from rear of car.

c. Support rear of shaft to underbody with fan belt or piece of wire.

d. Remove cardboard cover from yoke and lubricate O.D. of yoke with transmission fluid.

4. On Seventy-Five series cars, lubricate O.D. of slip yoke with transmission fluid. Insert rear portion of propeller shaft in support and support front section of shaft by hand.

5. Remove spare yoke previously installed in transmission extension housing and pack slip yoke lubricant between lips of transmission extension housing seal. Install slip yoke on transmission output shaft.

6. Install two bolts and lock nuts securing center bearing support to frame cross member, tightening to 18 foot-pounds.

7. Remove from support and position ball support yoke flange to pinion flange as marked upon removal and install two screws and lock washers. Torque screws to 70 foot-pounds.

See CAUTION on Page 4-3.

CAUTION: Engage emergency brake or service brake to hold propeller shaft when tightening flange attaching screws. Do not use a pry bar or heavy tool as universal joint bearing seals could be damaged.

8. Rotate propeller shaft to gain access to two remaining screw holes.

9. Install remaining two attaching screws. Torque screws to 70 foot-pounds. Remove support wire or belt used to support rear of shaft.

See CAUTION on Page 4-3.

10. Lower car and check transmission fluid level as described in Section 7, Note 6.

31. Propeller Shaft Torsional Damper—Seventy-Five and Commercial Only

a. Removal

1. Raise car with transmission in Neutral.

(NOTE: The torsional damper is machined as an assembly. Use extreme care to prevent mixing halves. Mark damper relationship to propeller shaft.)

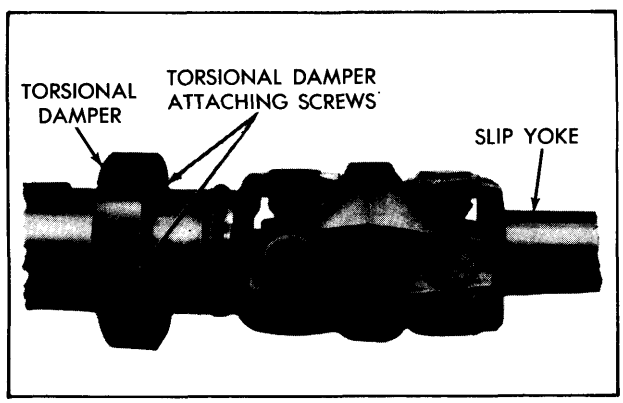


Fig. 4-31 Propeller Shaft Torsional Damper

BACK TO INDEX

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2. Remove one of two hex head screws securing split ring torsional damper to front of propeller shaft, Fig. 4-31.

3. Rotate propeller shaft to gain access to remaining screw.

4. Remove remaining screw and remove torsional damper from propeller shaft.

b. Installation

1. Position torsional damper on propeller shaft as marked upon removal and install one screw. Tighten screw to 20 foot-pounds.

2. Rotate propeller shaft to gain access to remaining screw hole.

3. Install remaining screw. Tighten screw to 20 foot-pounds.

4. After both torsional damper screws have been installed, recheck torque on both screws. It may be necessary to tighten the first screw a little more to obtain the proper torque.

5. Lower car.

32. Universal Joint Cross

(NOTE: If both crosses are to be removed, perform this procedure first on slip yoke (or ball support yoke) cross, then repeat procedure for inner cross beginning with Step 5. Remove bearing cups from link yoke first.)

a. Removal

1. Remove propeller shaft from car as described in Note 29a. If working on 75 or Commercial, remove propeller shaft as described in Note 30a. then separate front and rear sections according to Note 37a.

2. Scribe or punch alignment marks on all yokes for proper orientation on reassembly, Fig. 4-32.

3. Support propeller shaft in horizontal position in line with base plate of press.

4. Place ordinary mechanics 1-1/4" socket on press, with open end facing upward.

(NOTE: A piece of pipe of equal dimensions can be used in place of 1-1/4" socket.)

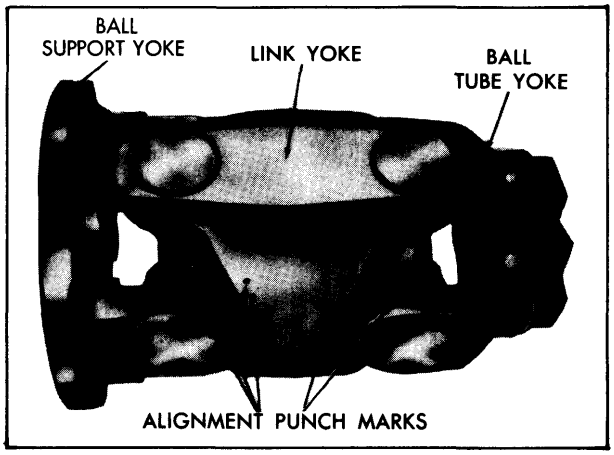


Fig. 4-32 Alignment Marks on Yokes

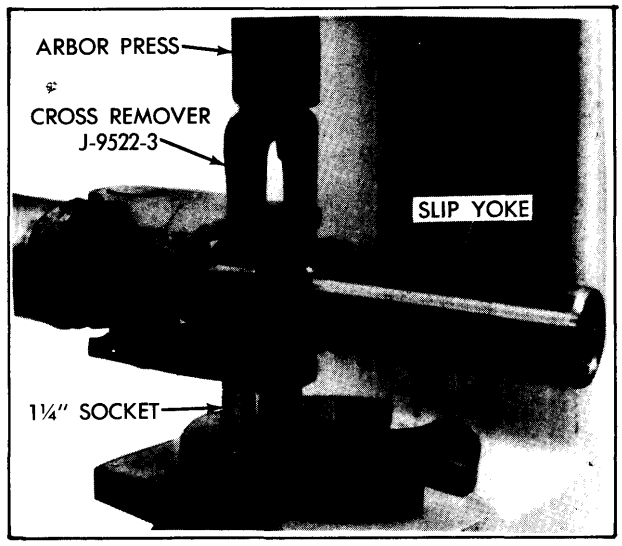


Fig. 4-33 Removing Bearing Cups

5. Position the appropriate ear of the link yoke over hole in socket.

6. If working on joint that has been serviced previously, remove snap rings from grooves in bearing cups.

7. Install Cross Remover, J-9522-3, over link yoke, engaging sides of bearing cups, Fig. 4-33. Use press to shear nylon injection of link yoke bearing cups and press bearing cup out of yoke as far as possible.

(NOTE: When press is operated, joint will angulate, causing opposite end of shaft to rise. This movement is necessary to remove bearing cups. Use other hand to support and guide shaft in its upward movement, and to lower shaft gently when press lever is released.)

8. Release press and remove Cross Remover, J-9522-3. Lift up on cross and position Spacer, J-9522-5, around lower journal, Fig. 4-34.

9. Position Cross Remover, J-9522-3, and continue pressing link yoke bearing cup from yoke.

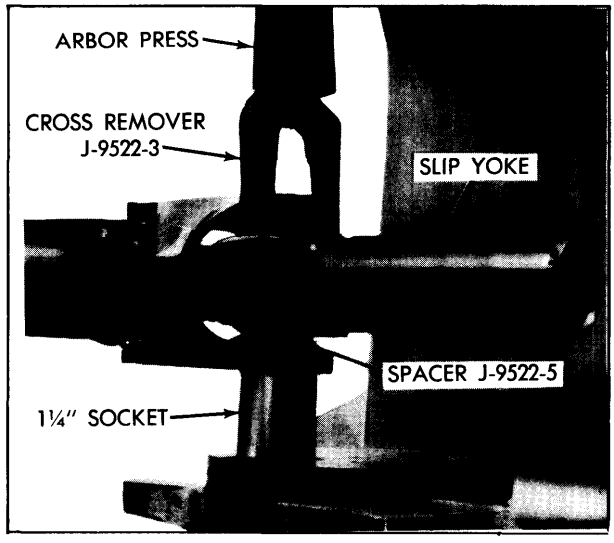


Fig. 4-34 Position of Spacer on Cross

BACK TO INDEX

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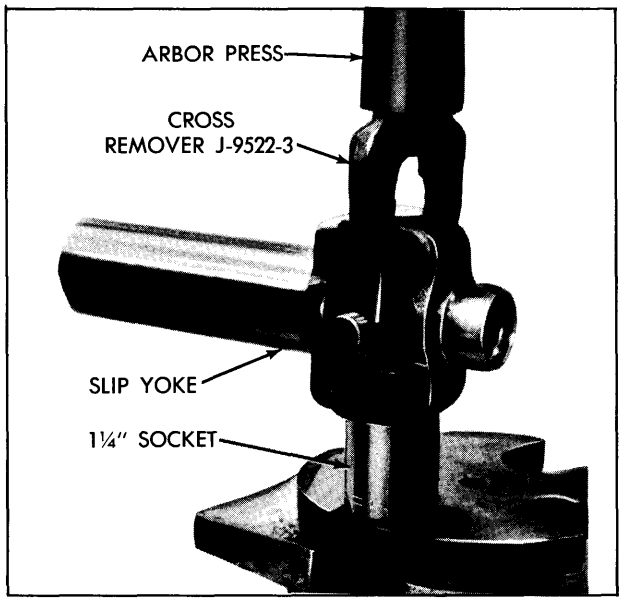


Fig. 4-35 Removing Cross

10. Repeat Steps 8 and 9 for other link yoke bearing cup.

11. Separate cross from link yoke, to gain access to centering ball.

12. Clean ball and examine thoroughly for rust, corrosion, distortion or excessive wear. If any of these conditions exist, replace ball and corresponding ball seat components. See Notes 35 and 36.

(NOTE: If ball does not need replacing, universal joint can be reassembled using a new service kit which contains two bearing cup assemblies, retainers and seals, and two snap rings. Follow Steps 7 thru 11 of the installation procedure.)

13. Position yoke and cross assembly on press and use Cross Remover, J-9522-3, to remove remaining bearing cups. Fig. 4-35.

(NOTE: Spacer, J-9522-5, is not necessary at this stage of procedure.)

b. Installation

Whenever a universal joint or bearing cup is removed, a service kit must be installed, as production universal joints have no snap ring grooves. Install only complete universal joint repair kits. Kits include a new cross, four bearing cup assemblies, retainers and seals, and four snap rings. Fig. 4-36.

1. Insert cross into yoke.
2. Insert one bearing cup assembly by hand.

CAUTION: Make certain all needles are properly seated in bearing cup. If any needles are missing or mispositioned, early failure will result.

3. Adjust position of cross so that one leg of cross is all the way into bearing. Make sure bearing is not cocked in yoke.
4. Maintain position of cross in bearing to keep needles seated, and firmly tap bearing cup into yoke, Fig. 4-37, until snap ring groove is exposed.
5. Install snap ring in groove in bearing cup, Fig. 4-38.
6. Repeat Steps 2 through 5 for opposite bearing assembly.

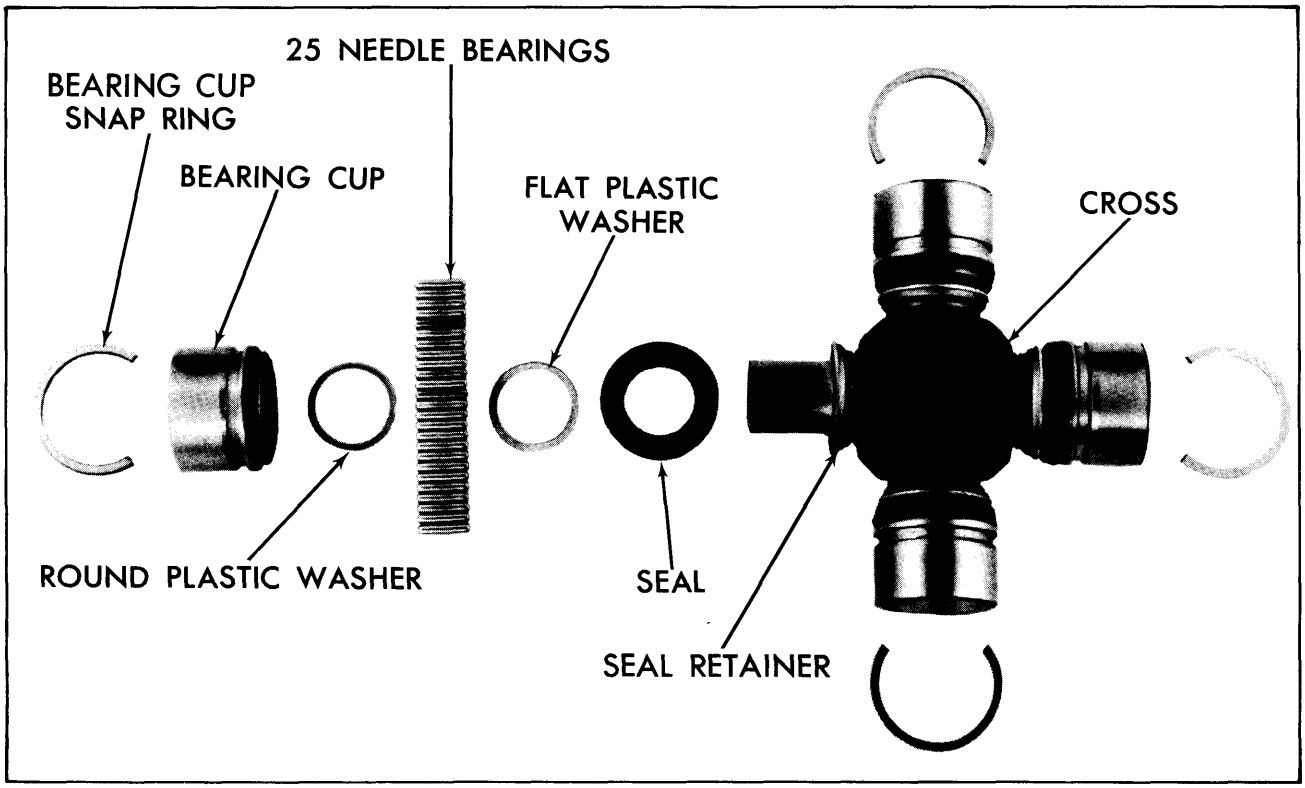


Fig. 4-36 Universal Joint Service Kit

BACK TO INDEX

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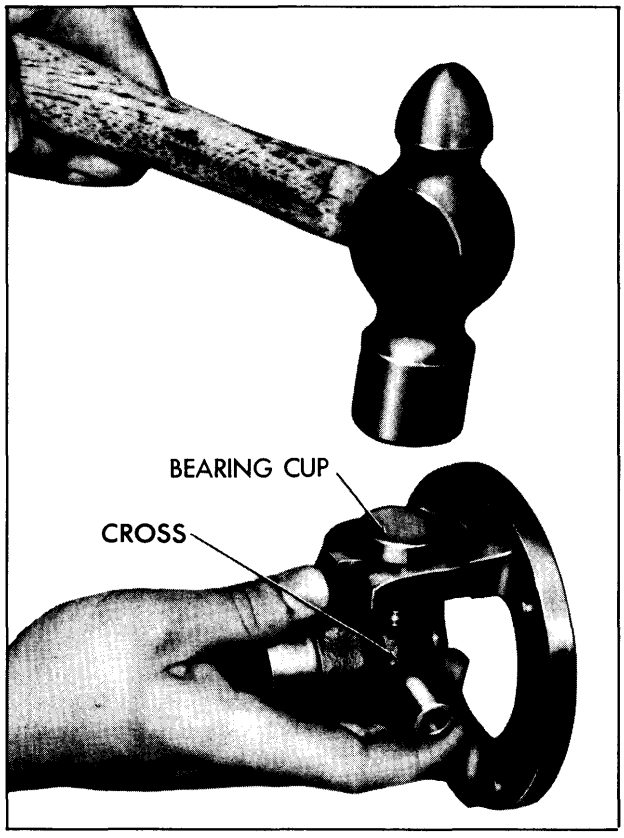


Fig. 4-37 Installing Bearing Cups

7. Position link yoke over yoke and cross assembly, observing alignment marks made on disassembly.

8. Repeat Steps 2 through 6 to install link yoke bearing cups.

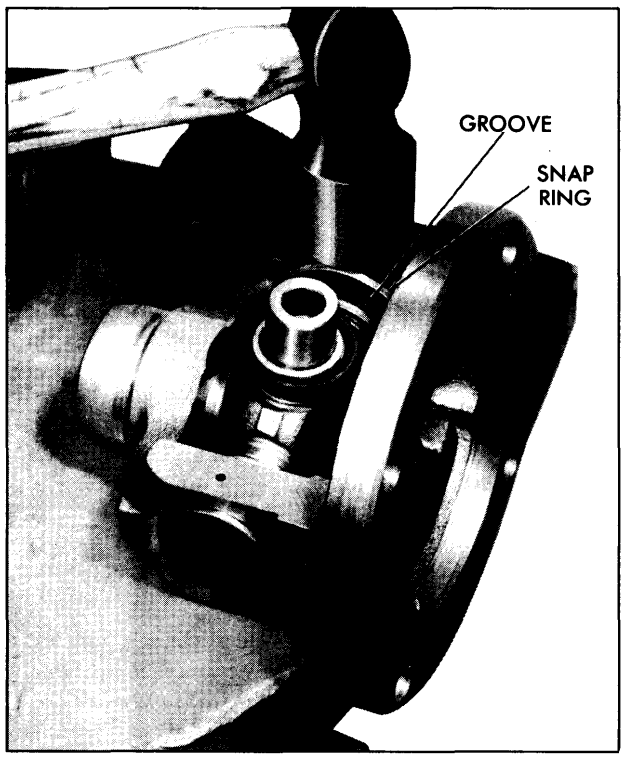


Fig. 4-38 Installing Snap Ring

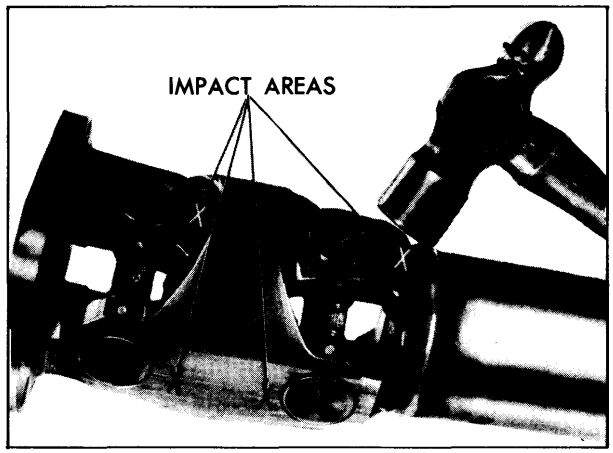


Fig. 4-39 Seating Bearing Cups and Snap Rings

9. Check cross for travel. Some resistance is normal and requires no furhter adjustment. If heavy resistance is encountered, strike yoke behind installed bearing cups, Fig. 4-39.

10. Install propeller shaft on car as outlined in Note 29b. If working on "75" or Commercial, assemble front and rear sections following procedures in Note 37b, then install shaft as is outlined in Note 27b.

11. Road test car. If a propeller shaft unbalance condition is found, rebalance propeller shaft as outlined in Note 28.

33. Slip Yoke or Ball Support Yoke

a. Removal

1. Remove propeller shaft from car as described in Note 29a. If working on "75" or Commercial, perform instead procedure in Note 30a, then separate front and rear sections according to Note 37a.

2. If slip yoke is to be replaced, inspect outer surface for rust, scratches, or gouges. Check internal splines for damage. If damage to yoke is not evident, yoke does not require replacement. In this event, thoroughly clean slip yoke with mineral spirits or kerosene and dry with compressed air. Lubricate I.D. of yoke and approximately two tablespoons of propeller shaft slip yoke lubricant. Part No. 105 0169, or equivalent and O.D. with transmission fluid. Inspect transmission extension housing oil seal and replace if necessary. Pack slip yoke lubricant, Part No. 105 0169, or equivalent, between lips of extension housing seal, then install propeller shaft.

3. Remove yoke from shaft following procedure in Note 32a, Steps 1 through 12.

b. Installation

1. Obtain yoke replacement kit. Kit consists of a new yoke, a cross with two bearing cups installed and nylon-injected, and two additional bearing cup assemblies, and two snap rings.

2. Inspect ball seat in yoke, making certain seat is liberally lubricated. Inspect two bearing cup assemblies to be sure all needles are properly positioned and lubricated.

BACK TO INDEX

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3. Position link yoke over cross and install bearing cups, observing procedure in Note 32b, Steps 2 through 6.
4. Install propeller shaft on car.
5. Rebalance shaft on car as described in Note 28.

34. Link Yoke

a. Removal

(NOTE: The link yoke can be replaced (serviced) without disassembly of the "U" joint from the tube yoke, support yoke or slip yoke.)

1. Perform procedure in Note 32, Steps 1 through 12, to remove slip yoke (or support yoke) cross from link yoke and to inspect ball for damage.
2. Remove link yoke from inner cross by repeating Steps 5 through 10, Note 32.

b. Installation

1. Obtain a new link yoke and either a kit with two bearing cup assemblies and two snap rings or a complete universal joint assembly as required.
2. Position link yoke on inner cross and install two bearing cup assemblies by following Note 32b, Steps 2 through 6.
3. Position slip yoke (or support yoke) cross in link yoke, orienting with tube yoke according to marks made on disassembly.
4. Repeat Steps 2 through 6, Note 32b to install remaining bearing cups.
5. Install propeller shaft.
6. Rebalance shaft on car as described in Note 28.

35. Propeller Shaft Centering Ball

a. Removal

1. To gain access to centering ball, perform Steps 1 through 12, Note 32a.

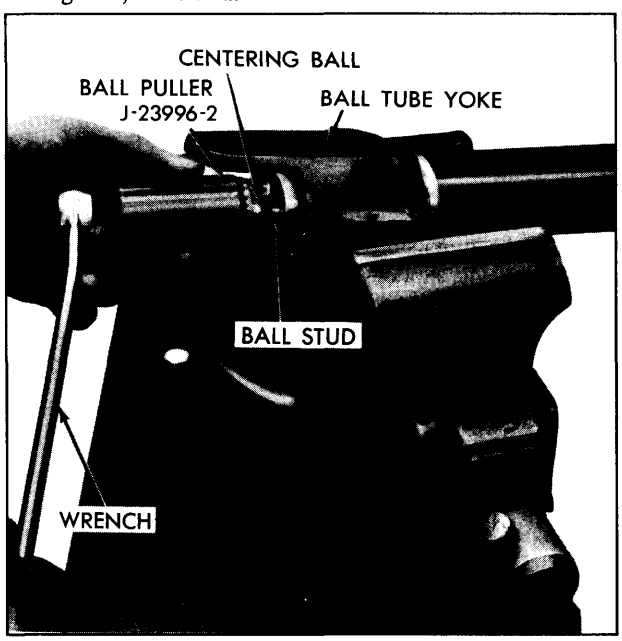


Fig. 4-40 Removing Centering Ball

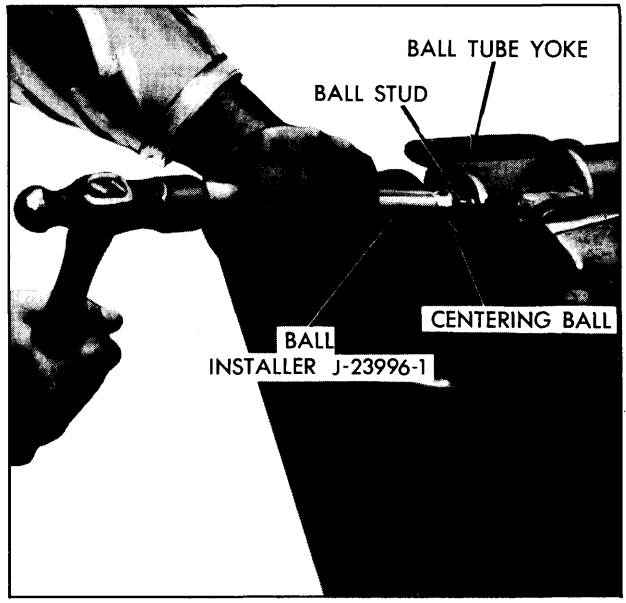


Fig. 4-41 Installing Centering Ball

2. Clamp shaft in bench vise as shown in Fig. 4-40 and install Ball Puller, J-23996-2, over ball. Tighten nut finger tight.

(NOTE: A light coat of multi-purpose grease applied to outer surface of jaws of ball puller tool, will reduce friction between jaws and inside surface of tool sleeve.)

3. Tighten nut until ball is removed from stud.

(NOTE: A ball and seat kit is available separately. It has two springs. Discard the pink (long) spring when used on a Cadillac.)

b. Installation

1. Position new ball on stud.
2. Position Ball Installer Tool, J-23996-1, against ball and drive with hammer, Fig. 4-41, until ball bottoms on stud.
3. Re-assemble and re-install shaft using Steps 1 through 11, Note 32b.

36. Ball Seat Assembly (Fig. 4-27)

a. Disassembly

1. Remove propeller shaft from car, Note 30a.
2. Remove slip yoke (or ball support yoke) from shaft to gain access to centering ball, following Note 32a, Steps 1 through 12.
3. Clean ball and examine thoroughly for rust, corrosion, distortion or excessive wear. If any of these conditions exist, replace ball and corresponding ball seat components.

(NOTE: If ball does not need replacing, universal joint can be reassembled using a new service kit which contains two bearing cup assemblies, retainers and seals, and two snap rings. Follow Note 32b, Steps 7 through 11.)

4. Pry grease seal from ball seat housing.

BACK TO INDEX

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CAUTION: Take care not to damage seal bore when prying seal.

5. Remove large washer, three shoes, small washer, and spring from seat housing.
6. Wash bore of housing thoroughly with mineral spirits to remove all traces of old lubricant and dry thoroughly with compressed air.

b. Assembly

(NOTE: A ball and seat kit is available separately. It has two springs. Discard the pink (long) spring when used on a Cadillac.)

1. Obtain ball and seat kit, Fig. 4-27.
2. Liberally grease the I.D. of the seat housing.
3. Insert spring, small washer, three shoes, and large washer into housing, thoroughly greasing each part as it is inserted.
4. Place grease seal on housing with seal lip facing down into bore.
5. Place Seal Installer, J-23694, over seal and tap seal into place, Fig. 4-42. Seal is installed when flush with housing.
6. Pack remaining grease in seat assembly and on seal. Make sure inner surfaces of shoes are liberally lubricated.
7. Position yoke and cross assembly in link yoke and install bearing cups, observing procedure in Note 32b, Steps 2 through 6.
8. Install propeller shaft, Note 30b.
9. Rebalance shaft on car as described in Note 28.

37. Front Section—Seventy-Five and Commercial

a. Disassembly

1. Remove propeller shaft assembly as described in Note 30a.

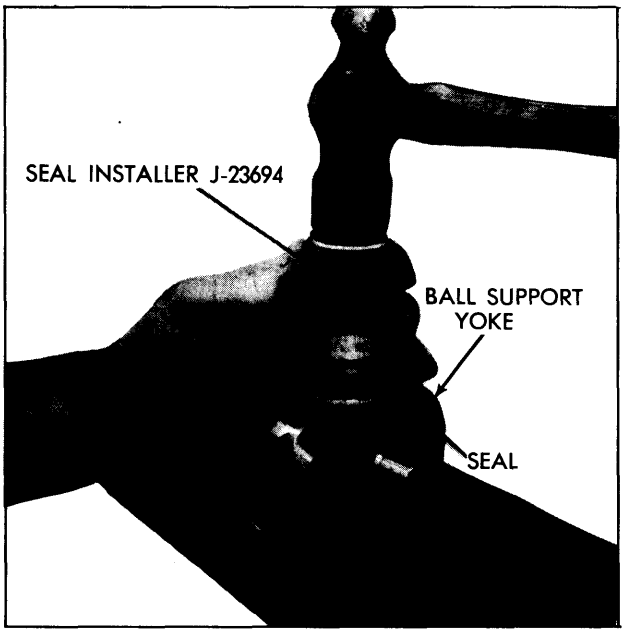


Fig. 4-42 Installing Ball Support Yoke Seal

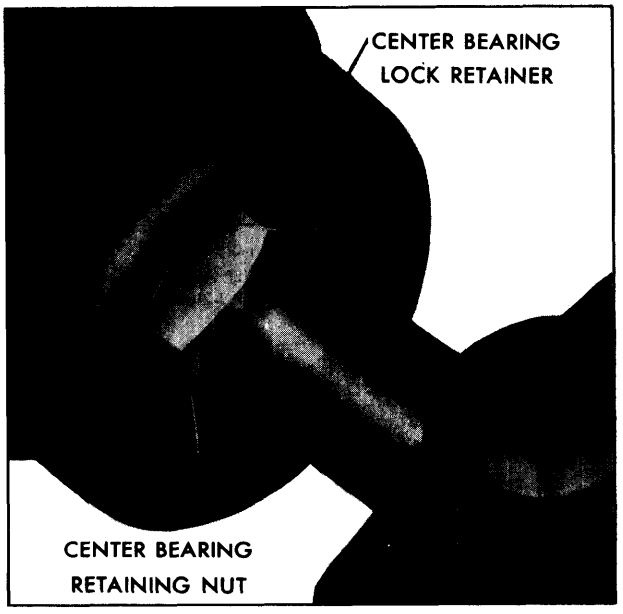


Fig. 4-43 Propeller Shaft Retainer

2. Pry up center bearing lock retainer, Fig. 4-43.
3. Back off center bearing retaining nut, using Center Bearing Retaining Nut Remover and Installer, J-21009, and separate front and rear propeller shafts by sliding front shaft off center slip yoke.
4. Remove and discard center bearing lock retainer if damaged.
5. Remove center slip yoke seal, split washer, and center bearing retaining nut from slip yoke. Inspect for damage or excessive wear.

b. Assembly

1. Clean spline of center slip yoke.
2. Install center bearing retaining nut on slip yoke with threaded end toward front propeller shaft.
3. Install split washer, being sure to slide washer securely against inner shoulder of retaining nut.
4. Slide slip yoke seal over center slip yoke and into retaining nut.
5. Install new center bearing lock retainer on center slip yoke.
6. Coat inner spline of front propeller shaft and spline of center slip yoke with center bearing slip yoke lubricant, Part No. 1050191, or equivalent.
7. Align wire clip on end of center slip yoke with missing land on inner spline of front shaft and slide center slip yoke into front propeller shaft spline.
8. Tighten center bearing retaining nut to 55 foot-pounds using Center Bearing Retaining Nut Remover and Installer, J-21009, and a torque wrench. Fig. 4-44.

CAUTION: Particular care should be taken in application of torque wrench and installer tool, to prevent over-torquing the nut. Hold torque wrench perpendicular to installer tool to cancel off-set error on torque reading.

9. Bend edge of center bearing lock retainer in two places to lock center bearing retaining nut.

BACK TO INDEX

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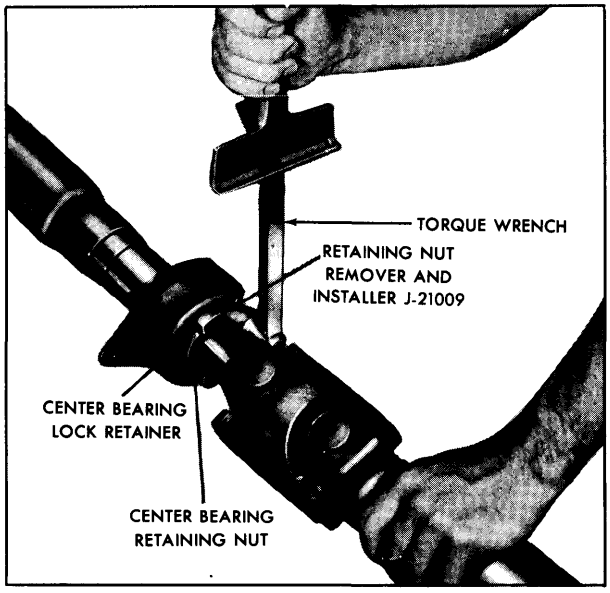


Fig. 4-44 Tightening Center Bearing Retaining Nut

10. Install propeller shaft assembly as described in Note 30b.

38. Center Bearing—Seventy-Five and Commercial

a. Removal

1. Remove propeller shaft assembly as described in Note 30a.
2. Disassemble front and rear propeller shafts as described in Note 37a.
3. Remove center bearing support and bracket assembly from front propeller shaft by tapping on front side of assembly with a soft head hammer or through a block of wood.
4. Remove slinger from end of propeller shaft.
5. Pry out snap ring from open side of bearing retainer and remove bearing from support bracket by tapping lightly from rear with a soft head hammer, or through a block of wood.

b. Installation

1. Install bearing into bearing retainer, pressing on outer race of bearing only. Use care not to damage bearing or support. Secure bearing in retainer with snap ring.
2. Pack front and rear face of center bearing with artic #5 grease or other heavy duty lubricant, such as water pump grease.
3. Install slinger on front propeller shaft.
4. Position center bearing support assembly on rear of front propeller shaft with snap ring facing rear end of shaft.

(It may be necessary to tap alternately on inner race of bearing with a brass drift to permit clearance for installing retaining nut.)

5. Assemble front and rear propeller shafts as described in Note 37a.
6. Install propeller shaft assembly as described in Note 30b.

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot-Pounds
300M	Pinion Flange to Universal Joint Flange Attaching Screws	7/16-20	70*
Special	Propeller Shaft Center Bearing Retaining Nut ("75" and Commercial)	1-9/16-18	55
300-M	Center Bearing Support Bolts ("75" and Commercial)	5/16-18	18
300-M (Special)	Propeller Shaft Torsional Damper Screws .	5/16-18	25
NOTE: Refer to back of manual, Page 16-1, for bolt and nut markings and steel classifications.			

**CAUTION: This fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.*

BACK TO INDEX

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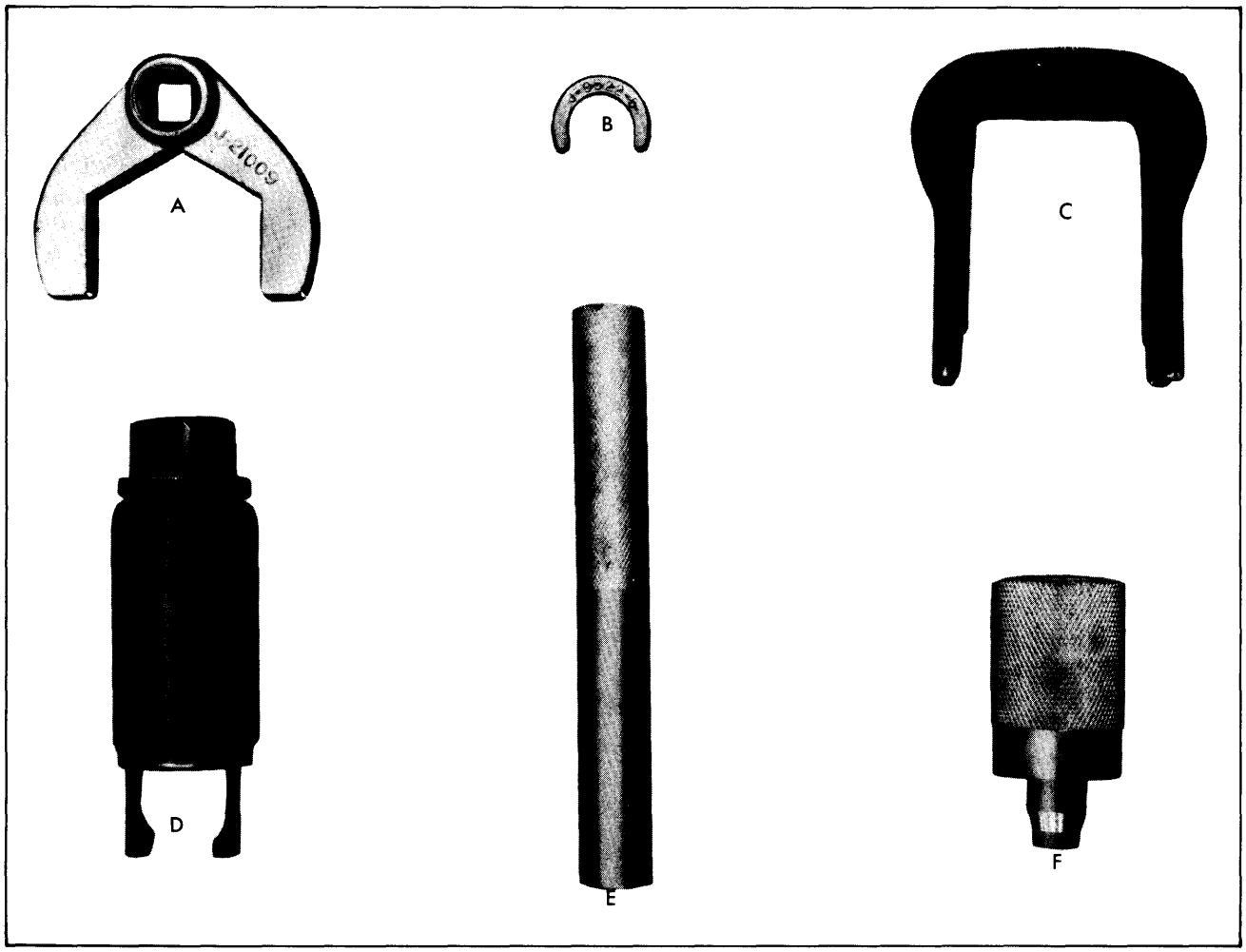


Fig. 4-45 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-21009	Center Bearing Retaining Nut Remover and Installer	D	J-23996-2	Ball Puller Tool
B	J-9522-5	Spacer	E	J-23996-1	Ball Installer Tool
C	J-9522-3	Cross Remover	F	J-23694	Ball Seat Seal Installer

BACK TO INDEX

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DIAGNOSIS

Bearing Failure Conditions

Whenever a front or rear wheel bearing or a pinion or differential bearing is removed, a careful inspection must be made to determine the cause of failure and whether any related parts have been damaged.

Before diagnosing a bearing problem, clean the cone assembly thoroughly in solvent and allow to dry completely.

(NOTE: If bearing has become magnetized, removal of metal particles from inside cage cannot be accomplished unless bearing is demagnetized.)

Compare bearing in question to the examples in Fig. 4-43 then refer to the corresponding explanation on this page and follow recommendations to prevent a similar failure in the replacement bearing.

Wear

Bearing lubricant is contaminated by fine particles of some abrasive material. The finish on the rollers and outer race has become dulled in uniform pattern. If wear is very minor the bearing need not be replaced.

Cage Wear

This is a more advanced case of wear in which even the roller cage has been affected. Unit must be replaced.

Step Wear

A different kind of wear pattern, affecting only the ends of the rollers, could develop from contaminated lubricant. If bearing is already rough or noisy it must be replaced. In any case, do not preload beyond specification on installation.

Indentations

Surface depressions or pits in the races or rollers are caused by hard particles of foreign material. If condition is at least as advanced as that shown in the example, discard bearing and outer race.

Regardless of whether or not replacement is necessary, if any bearing shows signs of indentation or of wear on race, rollers, or cage, the lubricant must be completely removed from the bearing assembly and all associated parts before refilling or repacking. All seals must be examined very carefully for damage that could admit contaminants. If these precautions are not followed, an identical failure could result.

Misalignment

The roller and cage assembly in this example is cocked with respect to the outer race. Check for small burrs or foreign material lodged between bearing and outer race or between race and housing. These surfaces must be absolutely smooth to prevent this type of failure.

Cracked Inner Race

When the press fit is at the inner race, a cocked assembly will result in a cracked inner race. This type of failure can be caused by improper removal and installation techniques. Always use the recommended tools when servicing bearings.

Fretting

"Fretting" is the term used to describe corrosion resulting from slight relative movement of parts with no coating of lubricant. Check and clean all related parts during the replacement procedure as these could also be damaged.

Stain Discoloration

Lubricant breakdown can leave brown or black stains. In this case, the unit is not necessarily defective. If light polishing removes the stain, the bearing can be reused.

Heat Discoloration

An overload on the bearing or deterioration of the lubricant will result in discoloration different from stain discoloration, although the two can be confused.

Stains ranging in color from faint yellow to dark blue indicate the possibility of softening of races or rollers. Draw a file across the discolored areas. If the file cuts metal, discard the bearing. If it glides readily over the affected parts, the bearing can be reused.

Galling

Metal smears on roller ends render bearings unusable. When installing new bearing, be certain that bearing is properly adjusted and that correct lubricant is used. Conduct a very careful examination of seals. This condition is easily caused when lubricant is allowed to escape.

Bent Cage

This kind of damage results from simple mishandling. Bearings are very vulnerable to forces other than those that they were designed to handle. A dent even as minor as the one pictured will ruin a bearing.

Always use a piece of cardboard or other soft covering on workbench when handling bearing parts.

Brinelling

A severe impact on a bearing or vibration while the unit is not rotating causes the rollers to dent the race surface. Often, this condition is related to extraneous circumstances (such as a collision) rather than a defect in the vehicle.

BACK TO INDEX

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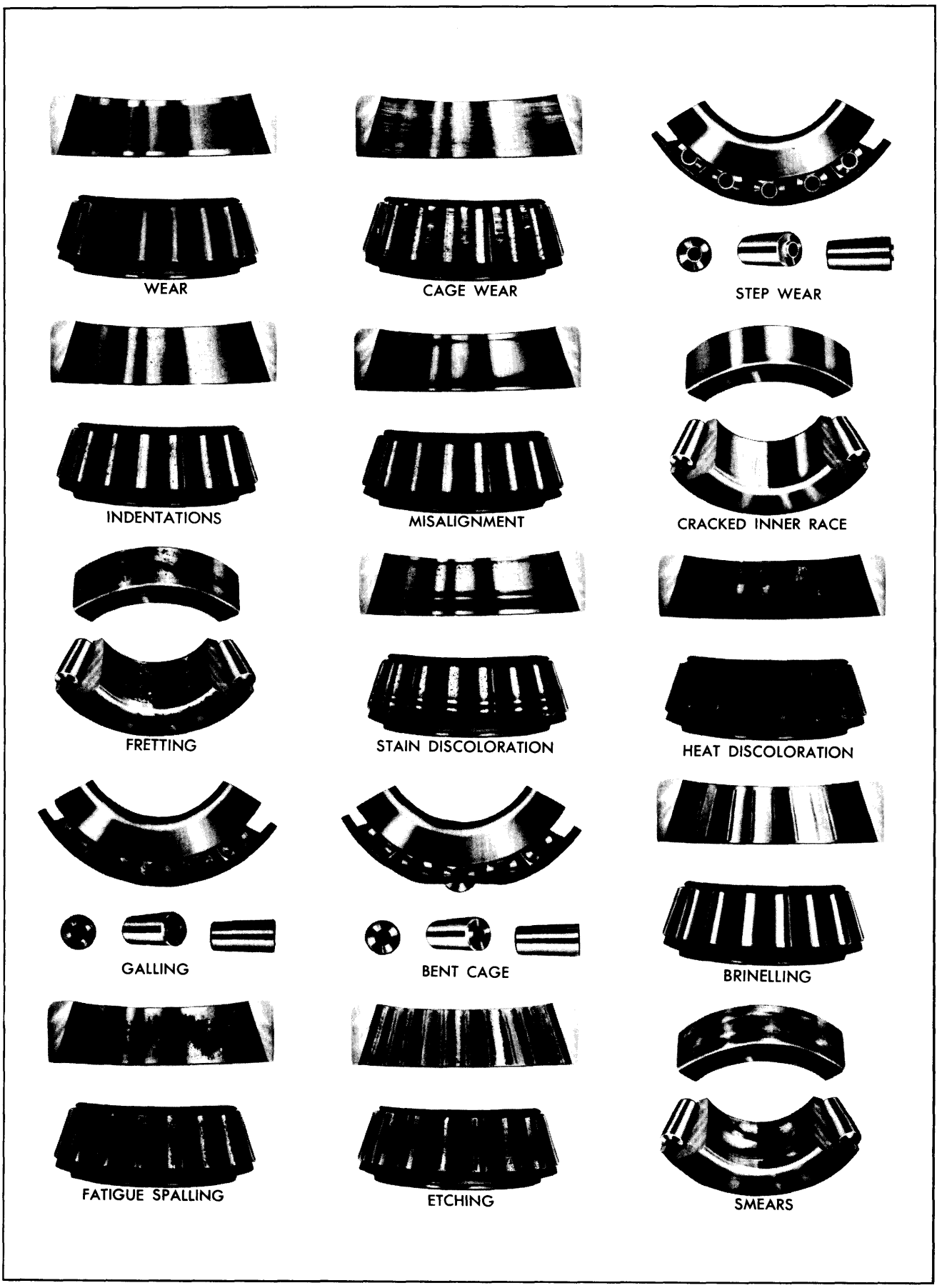


Fig. 4-46 Bearing Failure Conditions

BACK TO INDEX

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Fatigue Spalling

Fatigue spalling is the flaking of metal from bearing surfaces. These particles can cause further damage when car is back in service. Remove all lubricant and clean all related parts completely before reassembly with replacement bearing.

Etching

Bearing appears gray or grayish black and there is some erosion of surface metal of the race at the same spacing as the rollers. As in other cases in which hard particles have contaminated the lubricant, clean all parts thoroughly to prevent future damage. Check seals.

Smears

Smearing of metal can occur on any or all of the bearing surfaces. this is generally due to the overheating related to the unwanted slippage between parts, and this slippage generally stems from either a loose fit, poor lubricant, or an overload on the unit. When installing new bearing, make certain proper amount of correct lubricant is used and that bearing is adjusted to specification.

GENERAL DESCRIPTION

(NOTE: Rear axle service information pertaining to the Eldorado is covered at the back of this section beginning on Page 4-42.)

The rear axle housing used on all Cadillac cars except the Eldorado consists of a nodular cast iron center section that houses the ring and pinion gear set and the differential. In addition to the center section, there are two tube and bracket assemblies that are pressed into the center section and welded in place.

The housing incorporates attaching brackets for the rear springs, upper and lower control arms, and shock absorbers. The axle housing has a vent fitting on the left side to relieve internal pressure.

The Commercial Chassis uses two spring pads in place of the two spring attaching brackets for attaching the leaf springs.

SERVICE INFORMATION

CAUTION: If any mispositioning, incorrect assembly, or failure of components in the area of the brake system pipes, hoses, or cylinders is observed, be sure to check for any brake damage that may have resulted from such a condition and correct as required. Components that could damage the brake system due to mispositioning, incorrect assembly, or failure include the exhaust system, shock absorbers, springs, and suspension control arms.

CAUTION: When raising rear of car, support vehicle weight at frame or axle or both. Never use control arms as contact points for hoist or jack stands, as damage may result.

39. Rear Axle Backlash Measurement

1. Place car on hoist.
2. Disconnect propeller shaft as described in Note 29a.
3. Install Spacers, J-21044-5, over unthreaded holes of pinion flange.
4. Install Pinion Flange Holding Tool, J-8614-1, on spacers with raised side of tool against spacers and secure with two bolts and nuts.
5. Secure holding tool to lower control arm to prevent rotation of pinion flange.
6. Pull parking brake cable on one wheel to prevent wheel from turning. (This is not necessary on cars equipped with a Controlled Differential).
7. Measure rotation (backlash) of opposite wheel in inches of outer circumference of tire tread. A stiff wire pointer fastened to the fender or car frame will aid in this measurement. Maximum backlash under this condition should not exceed 1/2 inch on standard differentials and 1/8 inch on Controlled Differentials.

40. Rear Wheel and Brake Drum

a. Removal

1. Remove rear wheel shield and wheel disc.
2. Loosen wheel mounting nuts.
3. Raise rear end of car and place jack stands under rear frame rails.
4. Remove wheel mounting nuts and remove wheel. (Remove wheel spacer on Commercial series vehicles.)
5. Remove push nut securing brake drum to axle shaft flange. (Push nut is not used on Commercial series cars.)
6. Remove brake drum.

b. Installation

1. Install brake drum.
2. Install one push nut securing brake drum to axle shaft flange, except on Commercial series vehicles. (Install wheel spacer on Commercial series vehicles.)
3. Install wheel and replace wheel mounting nuts.
4. Remove jack stands, lower car, and tighten wheel mounting nuts to 130 foot-pounds.

See CAUTION on Page 4-3.

5. Install wheel disc and wheel shield.

BACK TO INDEX

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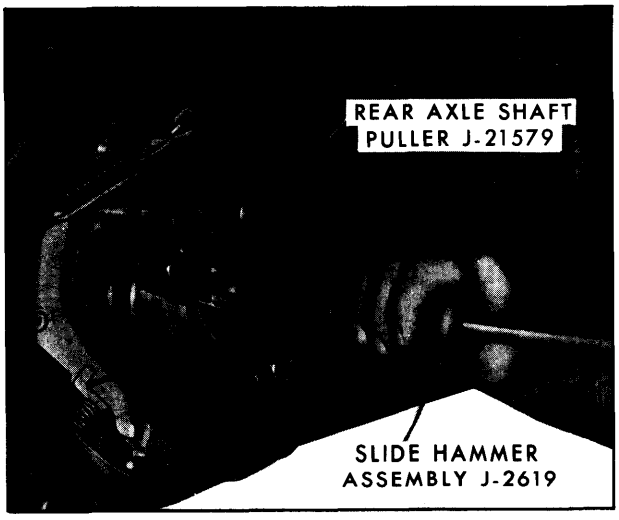


Fig. 4-47 Removing Rear Axle Shaft

41. Axle Shaft Bearing Oil Seal, and Wheel Bearing

a. Removal of Axle Shaft and Bearing Assembly

1. Raise rear end of car and remove wheel and brake drum as described in Note 40a.
2. Remove four nuts that secure retainer and backing plate to rear axle housing.
3. Attach Slide Hammer, J-2619, to Axle Shaft Puller, J-21579, using Adapter, J-2619-4.
4. Install Axle Shaft Puller, J-21579, on studs of rear axle shaft flange, Fig. 4-47.
5. Drive outward with slide hammer and remove axle shaft.

(NOTE: The tapered roller unit type rear wheel bearing, when new, is bonded together to facilitate installation. If tapered roller unit bearing is used, the bearing may separate when removing the axle shaft, leaving the outer race in the axle housing. This is a normal condition and does not indicate failure. If the bearing is to be replaced, make sure the old bearing outer race is removed from the housing before installing a new bearing.)

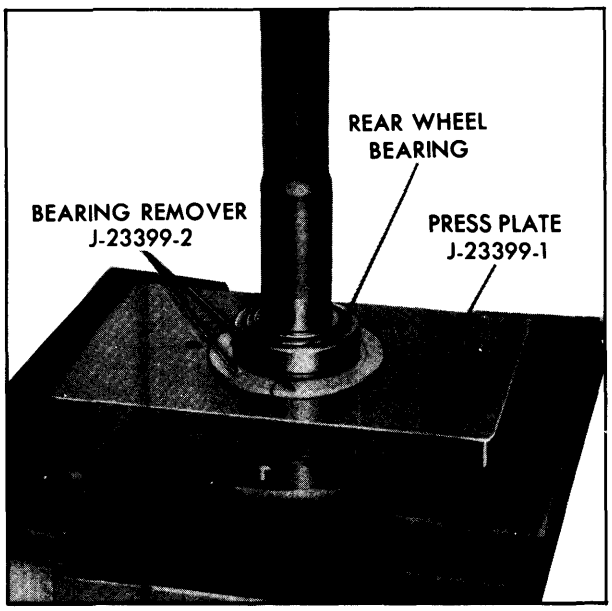


Fig. 4-48 Removing Rear Wheel Bearing

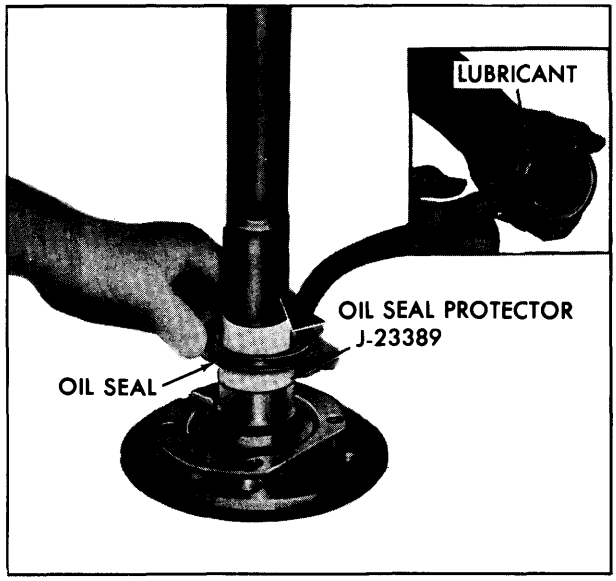


Fig. 4-49 Installing Rear Wheel Oil Seal

b. Removing Rear Wheel Bearing and Oil Seal

1. Using a cold chisel and hammer, split bearing retainer next to bearing, being careful not to damage bearing or shaft.

(NOTE: Bearing retainer must be completely split. Drive chisel into retainer until retainer separates, then remove and discard retainer.)

2. Stand axle shaft upright on flanged end. Using two screwdrivers, pry oil seal away from wheel bearing.
3. Slide Press Plate, J-23399-1, over axle shaft and into position between bearing and bearing retainer, Fig. 4-48.
4. Install both halves of Bearing Puller, J-23399-2 (J-23399-3 for "75" and Commercial Series) into Press Plate, J-23399-1, Fig. 4-48.
5. Position axle shaft and Press Plate in press and press bearing off axle shaft.

CAUTION: Make certain that axle shaft is properly centered in press so that axle shaft flange does not catch on side of press and become damaged.

6. Remove axle shaft from press.
7. Slide bearing, seal, and bearing puller tools up and off axle shaft.
8. Slide cover up and off axle shaft.

c. Installing Rear Wheel Bearing and Oil Seal

1. Wipe axle shaft and bearing clean.
2. Install bearing cover on axle shaft with raised side of cover against axle shaft flange, Fig. 4-49.

BACK TO INDEX

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3. Install Seal Protector, J-23389, on axle shaft with small end of protector pointing toward splined end of axle shaft, Fig. 4-49.

4. Lubricate lip of new oil seal with wheel bearing grease.

5. Install oil seal by gently pressing seal down over Seal Protector, J-23389. The oil seal is properly installed when the lip of the seal clears the large end of the seal protector.

(NOTE: When installing oil seal on "75" and Commercial series vehicle, use Seal Protector, J-23391.)

6. Apply a light coat of wheel bearing grease on bearing.

7. If tapered roller unit bearing is used, position bearing on axle shaft with narrow ring of bearing facing flanged end of axle shaft. If straight roller bearing is to be installed, loose ring at one end of inner race must be installed toward the flange.

8. Position Bearing Installer, J-6257, on shaft and place axle shaft on press, making certain that axle shaft is properly centered in bearing installer, Fig. 4-50.

9. Press bearing on axle shaft until bearing bottoms against shoulder on shaft.

10. Remove Bearing Installer, J-6257, and position retainer on axle shaft.

11. Position Bearing Installer, J-6257, on shaft and place axle shaft on press, making certain that axle shaft is properly centered in bearing installer.

12. Press retainer on axle shaft until retainer bottoms against bearing.

13. Remove Bearing Installer, J-6257, from axle shaft.

d. Installing Axle Shaft and Bearing Assembly

(NOTE: If rear wheel bearing has been removed because of failure, inspect axle housing and differential carrier for metal chips and clean thoroughly.)

1. Apply a thin film of wheel bearing grease to wheel bearing bore in axle housing after checking housing for nicks and burrs.

Lubricate oil seal and outer race of bearing with bearing grease.

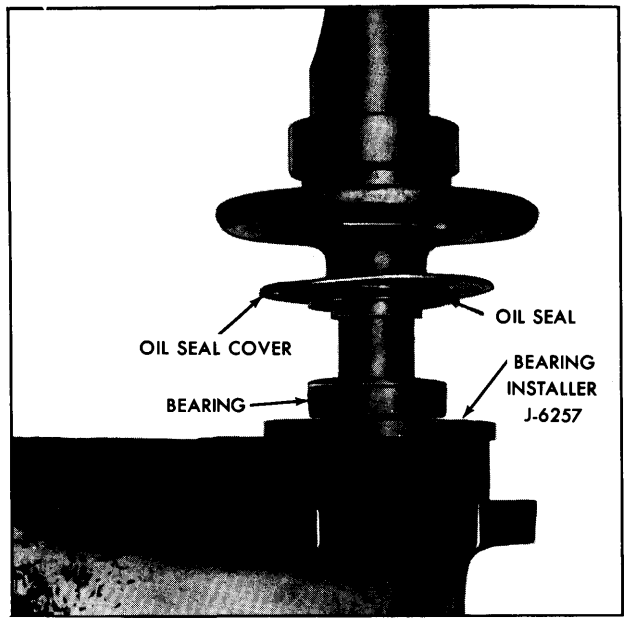


Fig. 4-50 Installing Rear Wheel Bearing

3. Install new gasket on brake backing plate.

4. Install axle shaft into axle housing, using extreme care to align oil seal cover with axle housing mounting bolts.

(NOTE: It may be necessary to rotate axle shaft to permit axle shaft splines to engage differential side gear splines.)

5. Install four nuts on axle housing flange bolts to hold gasket, brake backing plate, and oil seal cover in place. Tighten nuts to 50 foot-pounds by inserting a socket wrench through large holes in rear axle shaft flange.

6. Install brake drum and one push nut.

7. Install wheel and lower car. Tighten wheel mounting nuts to 130 foot-pounds.

See CAUTION on Page 4-3.

8. Install wheel disc and wheel shield.

SPECIFICATIONS

Series	Brg. Bore Diameter	Axle Shaft Length Lefthand	Axle Shaft Length Righthand
All Except Seventy-Five and Commercial			
Std. Diff.	1.564	28.50	34.02
Contr. Diff.	1.564	27.71	34.81
Seventy-Five and Commercial			
Std. Diff.	1.773	28.50	34.02
Contr. Diff.	1.773	27.71	34.81

BACK TO INDEX

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TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot Pounds
301-M	Brake Backing Plate to Axle Housing Nuts . .	7/16-14	50*
286-M	Wheel Mounting Nuts	1/2-20	130*
286-M	Shock Absorber Lower Mounting Nut	1/2-20	50

**CAUTION:* *These fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. Each must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.*

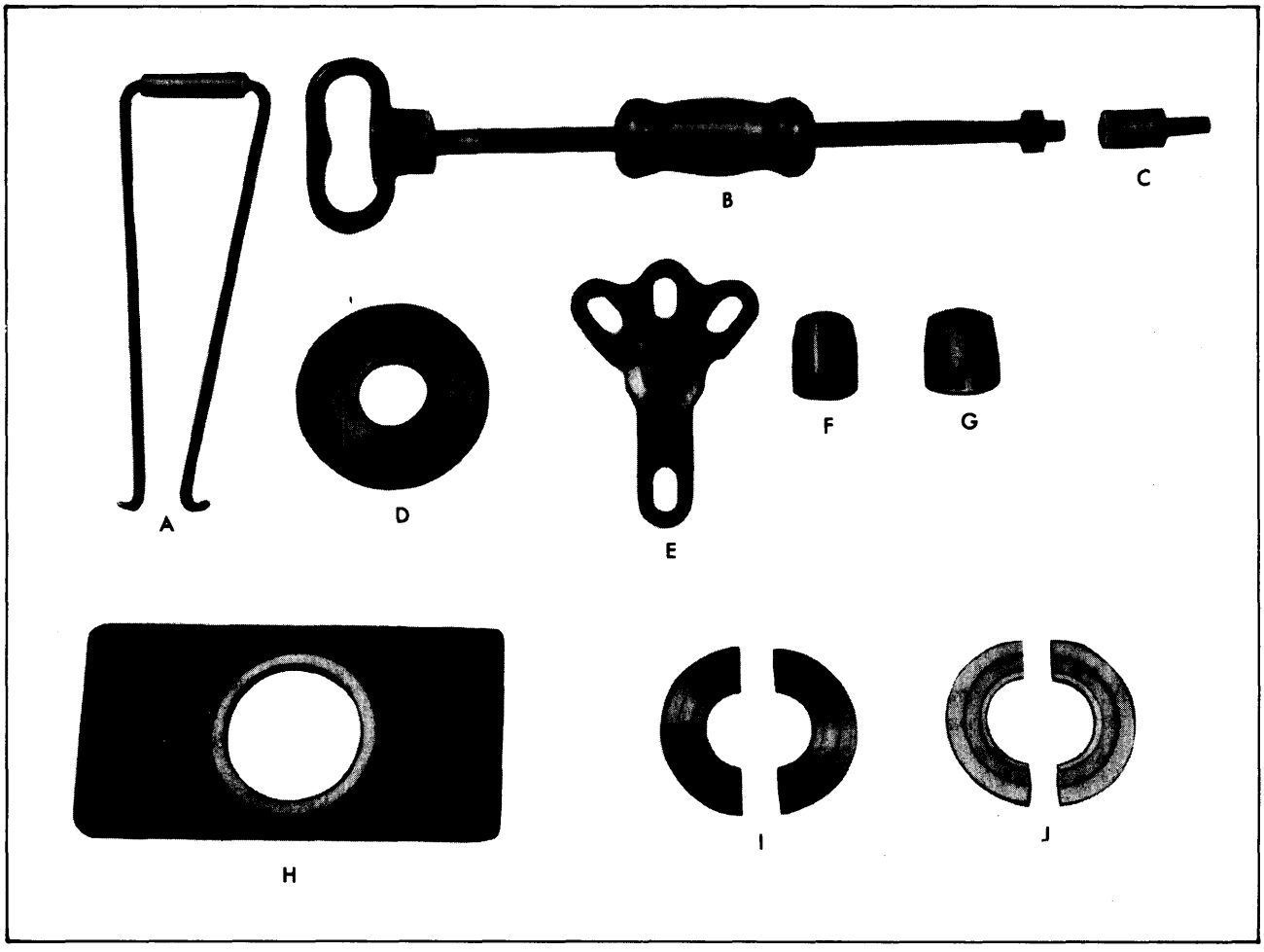


Fig. 4-51 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-943	Bearing Cup Remover	G	J-23391	Axle Shaft Seal Protector (Except Std. and Eldorado)
B	J-2619	Slide Hammer	H	J-23399-1	Axle Bearing Press Plate
C	J-2619-4	Adapter	I	J-23399-2	Bearing Remover (Standard Car)
D	J-6257	Rear Wheel Bearing Installer	J	J-23399-3	Bearing Remover(Except Standard Car)
E	J-21579	Rear Axle Shaft Puller			
F	J-23389	Axle Shaft Seal Protector (Standard Car)			

BACK TO INDEX

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GENERAL DESCRIPTION

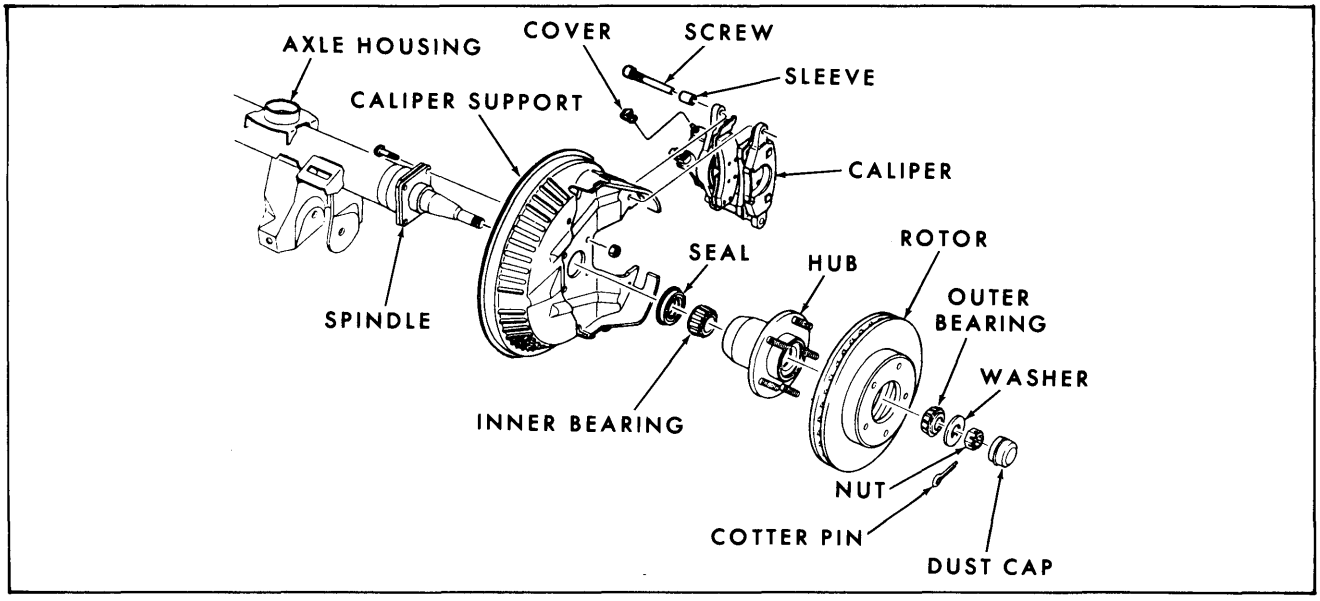


Fig. 4-52 Rear Wheel Disassembled — Eldorado

The rear axle used on the Eldorado is a straight, hollow tube, Fig. 4-52. The rear wheel spindles are pressed into and bolted to the axle tube assembly. On cars equipped with Track Master system, speed sensors are attached to each rear brake backing plate and the wiring harness is routed across the top of the axle.

Tapered roller bearings are used in the rear hubs. For diagnosis information pertaining to this type of bearing, refer to Fig. 4-46 and the corresponding text.

SERVICE INFORMATION

The following service information pertains only to the Eldorado rear axle. For service procedures not given, refer to the forward portion of the appropriate subsection as the procedures are the same as on other Cadillacs.

CAUTION: If any mispositioning incorrect assembly, or failure of components in the area of the brake system pipes, hoses, or cylinders is observed, be sure to check for any brake damage that may have resulted from such a condition and correct as required. Components that could damage the brake system due to mispositioning, incorrect assembly, or failure include the exhaust system, shock absorbers, springs, and suspension control arms.

CAUTION: When raising rear of car, support vehicle weight at frame or axle or both. Never use control arms as contact points for hoist or jack stands, as damage may result.

42. Rear Wheel Bearing Adjustment

Regularly scheduled rear wheel bearing repacking is not required. When major brake service is being performed, however, it is recommended that the rear wheel bearings be cleaned and repacked with a high melting point grade 2 lithium grease.

Adjustment of the rear wheel bearings should be made while revolving the wheel at least three times the speed of nut rotation when taking the torque readings.

1. While rotating hub assembly, tighten spindle nut to 25-30 foot-pounds.
2. Back nut off 1/2 turn, then retighten nut to 2 foot-pounds and install cotter pin.
3. If cotter pin cannot be installed in either of the two available holes in the spindle, with the nut at 2 foot-pounds, back nut off until cotter pin can be installed.
4. The rear hub must be rotated at least three revolutions during tightening of spindle nut. The final adjustment to be 2 foot-pounds nut torque to .004 bearing end play.
5. Peen end of cotter pin over sufficiently against side of nut. Cotter pin must be tight after installation. If it can be moved with finger, vibration may cause it to wear and break.
6. Install dust cap.

43. Rear Hub

a. Removal

1. Remove wheel shield, wheel disc and loosen wheel mounting nuts.
2. Raise rear end of car.
3. Remove wheel and tire assembly.
4. Remove caliper and disc as described in Section 5, Note 37.

BACK TO INDEX

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5. Remove dust cap, cotter pin, spindle nut, washer and outer cone and roller assembly, Fig. 4-52.
6. Carefully pull hub off of spindle.

b. Installation

1. Install rear hub on spindle, after wiping any accumulated grease from spindle, leaving only a light film.
2. Install outer cone and roller assembly and washer over spindle into hub, and install spindle nut fingertight.
3. Adjust rear wheel bearing as described in Note 42, Steps 1 through 6.
4. Install rear brake disc and caliper as described in Section 5, Note 37.
5. Position wheel assembly on hub, installing wheel mounting nuts finger tight.
6. Lower car.
7. Tighten wheel mounting nuts to 130 foot-pounds.

See CAUTION on Page 4-3.

44. Rear Wheel Bearings and Grease Retainer (Fig. 4-52)

a. Removal

1. Remove hub assembly as described in Note 43.
2. Pry grease retainer from inner side of hub.

(NOTE: The inner bearing grease retainer tool, Section 3, Fig. 3-32, may be used to remove the grease retainer.)

3. Remove inner cone and roller assembly from hub.

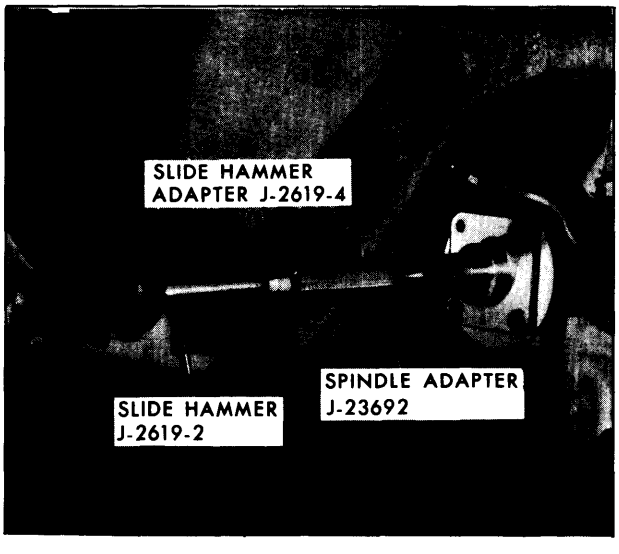


Fig. 4-53 Removing and Installing Rear Spindle

4. Inner and outer bearing cups are press fitted in hub, and can be removed, if necessary, by driving out from opposite side with a brass drift.

b. Inspection

1. Thoroughly clean all parts in clean solvent.
2. Check bearings for cracked separators and worn or pitted rollers.
3. Check bearing races for defects, using Fig. 4-46 as a guide.

c. Installation

1. If inner bearing cup was removed, drive or press cup, small I.D. side first, into inner side of hub, using Universal Handle, J-8092 and Inner Bearing Cup Installer, J-8458.
2. If outer bearing cup was removed, drive or press cup, small I.D. side first, into outer side of hub, using Universal Handle, J-8092, and Outer Bearing Cup Installer, J-8849.
3. Pack bearing cage with high melting point grade 2 lithium grease. Use a commercial bearing packer or pack bearings by hand, forcing grease in at large end of cage until it protrudes from the small end.
4. Install inner cone and roller assembly into inner side of hub.
5. Drive or press new grease retainer into inner side of hub, using Universal Handle, J-8092, screwed into a flat sided tool, such as J-23114.

(NOTE: If J-23114 is used, screw Universal Handle into reverse side of tool.)

6. Wipe spindle clean and apply a thin film of wheel bearing grease to spindle.
7. Install rear hub as described in Note 43b.

45. Rear Wheel Spindle—On Car

a. Removal

1. Raise rear of car.
2. Remove rear hub as described in Note 43a.
3. Remove four nuts securing spindle to axle housing.
4. Start one brake axle housing to spindle nut just far enough to engage threads.
5. Attach Adapter, J-2619-4, to Slide Hammer, J-2619, and attach Spindle Adapter J-23692 to Adapter J-2619-4, and install assembly on spindle, Fig. 4-53.

(NOTE: Make sure all threads are fully seated.)

6. Use slide hammer assembly to drive spindle from axle.
7. Remove remaining spindle to housing bolt and nut and remove spindle.
8. Remove slide hammer assembly from spindle.

BACK TO INDEX

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b. Installation

(NOTE: If spindle threads were damaged on removal, use a 3/4"-20 thread chaser to correct damage.)

1. Attach slide hammer assembly to new spindle, making sure threads are fully seated.
2. Drive new spindle into axle until spindle is fully installed, Fig. 4-53.
3. Install new gasket on wheel spindle.
4. Install rear hub as described in Note 43b.
5. Bleed brakes, Section 5, Note 6.

46. Rear Axle

a. Removal

1. Remove wheel shields, wheel discs, and loosen wheel mounting nuts.
2. Raise car on hoist and place jack stands under frame side rails.
3. Lower hoist.
4. Raise hoist just enough to support weight of axle (about 3/8").
5. Remove wheel mounting nuts and both wheel and tire assemblies.
6. Remove rear hub assemblies as described in Note 43a, Steps 3 through 6.
7. If car is equipped with Track Master system, disconnect wiring connectors from sensors and wiring harness from rear brake pipe over axle and position harness out of way.
8. Disconnect rubber brake hose and cap the hose to minimize fluid leakage.
9. Disconnect overtravel link from bracket on rear axle.
10. Deflate shock absorbers by disconnecting white air line at height control valve.
11. Remove wheel spindles following procedure outlined in Note 45a.
12. Disconnect shock absorbers at lower mounts and position out of way.
13. Raise axle to relieve tension on upper control arms and remove bolt and nut securing each upper control arm to axle brackets.

WARNING: STAND CLEAR OF AXLE ASSEMBLY WHEN PERFORMING NEXT STEP. SPRINGS COULD SNAP FROM THEIR SEATS RESULTING IN POSSIBLE INJURY OR DAMAGE.

14. Carefully lower axle until spring tension is relieved, then remove springs by hand.
15. Remove bolt and nut securing each lower control arm to its axle bracket.

(NOTE: Axle may have to be rotated slightly in order to remove bolts).

16. Remove rubber bumpers from top of axle housing.
17. Lower axle and remove from car.
18. Remove brake pipes and etc. from axle housing.

b. Installation

1. Install rubber bumpers on top of new axle.
2. Secure brake pipes to axle using four clips.
3. Position brake pipe distributor to axle and secure with screw.
4. Position new axle under car.
5. Raise axle only as far as necessary to insert lower control arms in axle brackets. Install lower arms and bolts and nuts but do not torque at this time.

(NOTE: It may be necessary to rotate axle slightly to align bolt holes. If so, use a jack stand at front or rear of one of the lower control arm brackets while adjusting axle height with hoist.)

6. Pivot upper control arms upward and secure arms temporarily in this position.
7. Fully extend shock absorbers; then raise axle until shock absorbers lower mounts are aligned. However, do not install shock absorbers at this time.
8. Install spring insulators and install springs, indexing as shown in Fig. 4-11. Raise axle just enough to compress springs slightly.
9. Drop upper control arms into axle brackets and install bolts and nuts. Do not torque at this time.
10. Position shock absorbers in lower mounts and install nuts.
11. Connect white air line to superlift port of height control valve.
12. Raise overtravel lever briefly to allow air into shock absorbers.
13. Connect overtravel lever to axle bracket. Shock absorbers will exhaust to residual pressure of 8-15 psi.
14. Raise axle until weight of car is supported by front and rear suspensions. Remove jack stands.
15. Torque lower control arm bolts while holding nuts to 145 foot-pounds, upper control arm bolts at frame to 145 foot-pounds, upper control arm bolts at axle to 110 foot-pounds, and shock absorber lower mounting nuts to 50 foot-pounds.

See CAUTION on Page 4-3.

16. Uncap rubber hose and connect to brake pipe distributor.
17. If equipped with Track Master system, route harness along top of axle and secure to brake pipe.
18. Install wheel spindles as described in Note 45b, Steps 1 through 6.
19. Install rear wheel hubs as described in Note 43b.
20. Using service valve, inflate Automatic Level Control system to 140 psi, or maximum pressure available.
21. Bleed brakes, Section 5, Note 6.
22. If equipped with Track Master, install wiring connectors on sensors.
23. Remove jack stands and lower car.
24. Tighten wheel nuts to 130 foot-pounds.
25. Install wheel discs and wheel shields.

BACK TO INDEX

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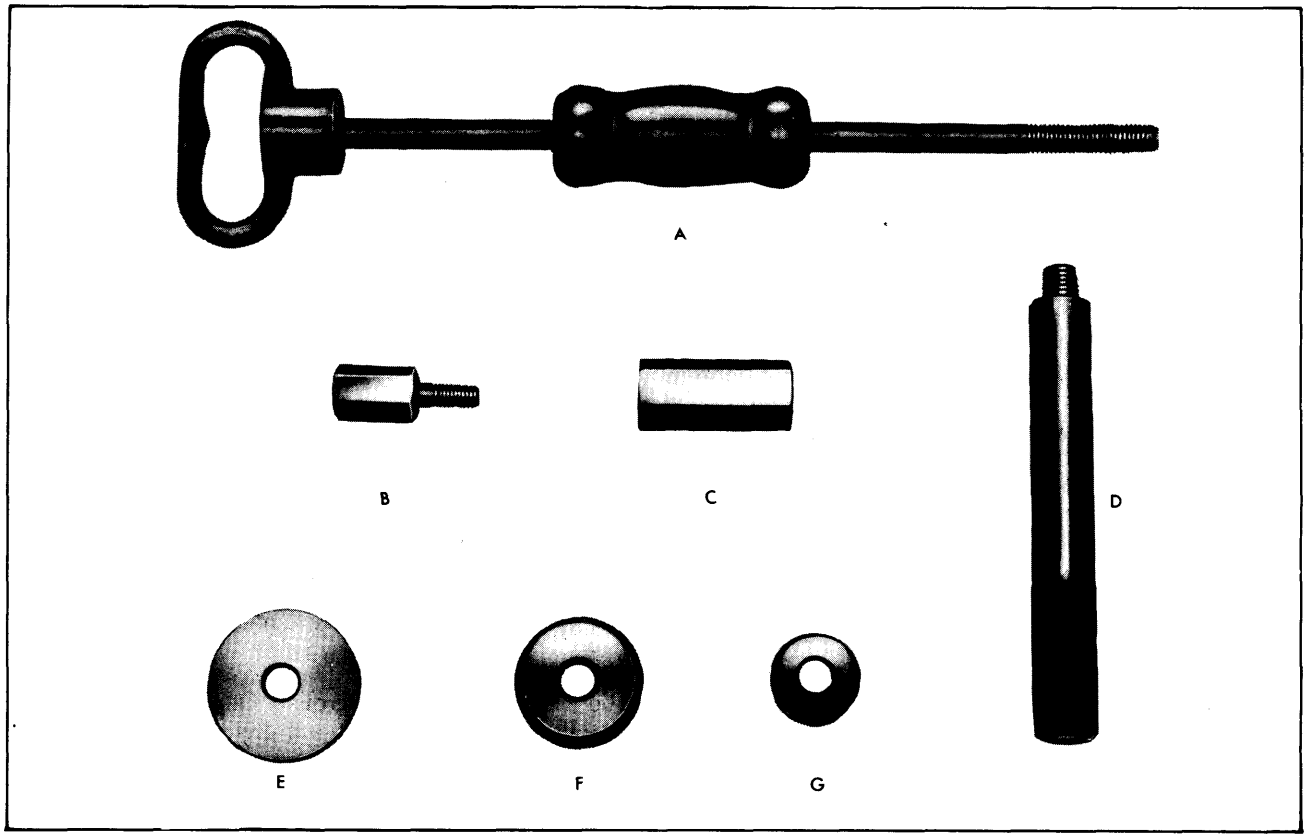


Fig. 4-54 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-2619	Slide Hammer	E	J-23114	Grease Retainer Installer
B	J-2619-4	Slide Hammer Adapter	F	J-8458	Inner Bearing Cup Installer
C	J-23692	Spindle Adapter	G	J-8849	Outer Bearing Cup Installer
D	J-8092	Universal Handle			

BACK TO INDEX

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GENERAL INFORMATION

(NOTE: The following information is not applicable to the Eldorado.)

The standard differential, incorporating a unitized carrier and housing design, Fig. 4-55, is used on all Cadillac cars except the Eldorado, and is completely serviceable. The Controlled Differential gear case, using the same carrier and housing design, fig. 4-96, is available on all Cadillac cars except the Eldorado, and is serviceable only as a unit.

This axle design utilizes two tapered roller bearings and a straight roller straddle bearing to support the pinion and provide rigidity. Adjustment of the pinion depth is accomplished through the use of shims at the pinion retainer to differential carrier connection.

Controlled Differential

The Controlled Differential gear case is serviced only as a complete assembly.

The pinion depth, differential backlash and side bearing preload adjustments are made using the same procedures that are used in adjusting the standard differential.

The basic advantage of the optional Controlled Differential over the standard differential is that the major driving force is always directed to the wheel having the greater traction. The unit is not a positive lock type. It will slip before an excessive amount of torque is directed to one rear wheel.

The main purpose of the Controlled Differential is to reduce the possibility of the car getting stuck while driving under slippery conditions. It also minimizes wheel spin and resultant drive line shock when accelerating on an uneven road surface.

During normal driving and cornering, the Controlled Differential unit functions as a standard differential. When one wheel encounters a slippery surface, however, the Controlled Differential allows the wheel with the greater traction to drive the car.

Wheelspin can occur if over-acceleration is attempted. However, the major driving force will still be directed to the wheel having the greater traction. This condition does not indicate failure of the unit.

When checking the runout of rear wheels on cars equipped with Controlled Differential, be sure to raise both rear wheels off the ground. Otherwise, the wheel in contact with the ground will drive when the opposite wheel is raised and rotated.

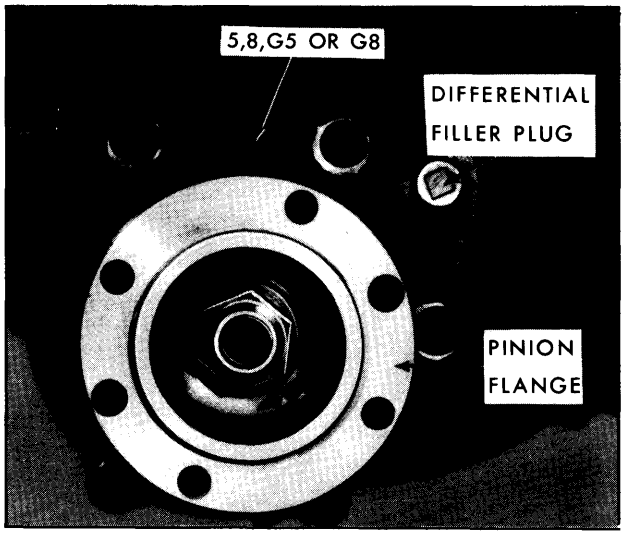


Fig. 4-56 Gear Ratio Identification

Differential Carrier Gear Ratios

The differential carrier gear ratios used on the different series cars provide maximum performance and economy for each series.

The gear ratio of the rear axle assembly can be determined by an identification number placed on the differential, as shown in Fig. 4-56.

Ratio	Identification Number*
2.73 -1	8
3.15–1	5

*Letter "G" preceding the identification number indicates a Controlled Differential

SERVICE INFORMATION—Except Eldorado

47. Pinion Oil Seal Replacement

a. Removal

1. Raise car on hoist and place jack stands under rear frame cross member. Lower axle to improve access.

2. To preserve balance, scribe an alignment mark between propeller shaft rear flange and pinion flange for proper orientation on re-installation. (Presence of hose clamps on rear of propeller shaft indicate that a field rebalancing procedure has been performed.)

Install wire to support propeller shaft, then disconnect propeller shaft in the following manner.

a. Of the four universal joint flange attaching screws and lockwashers, remove the two that are most accessible.

b. Rotate propeller shaft to gain access to remaining two flange attaching screws and lockwashers.

c. Remove screws and lockwashers, separate flanges, and allow shaft to rest on wire.

3. Place a drain pan under differential.

BACK TO INDEX

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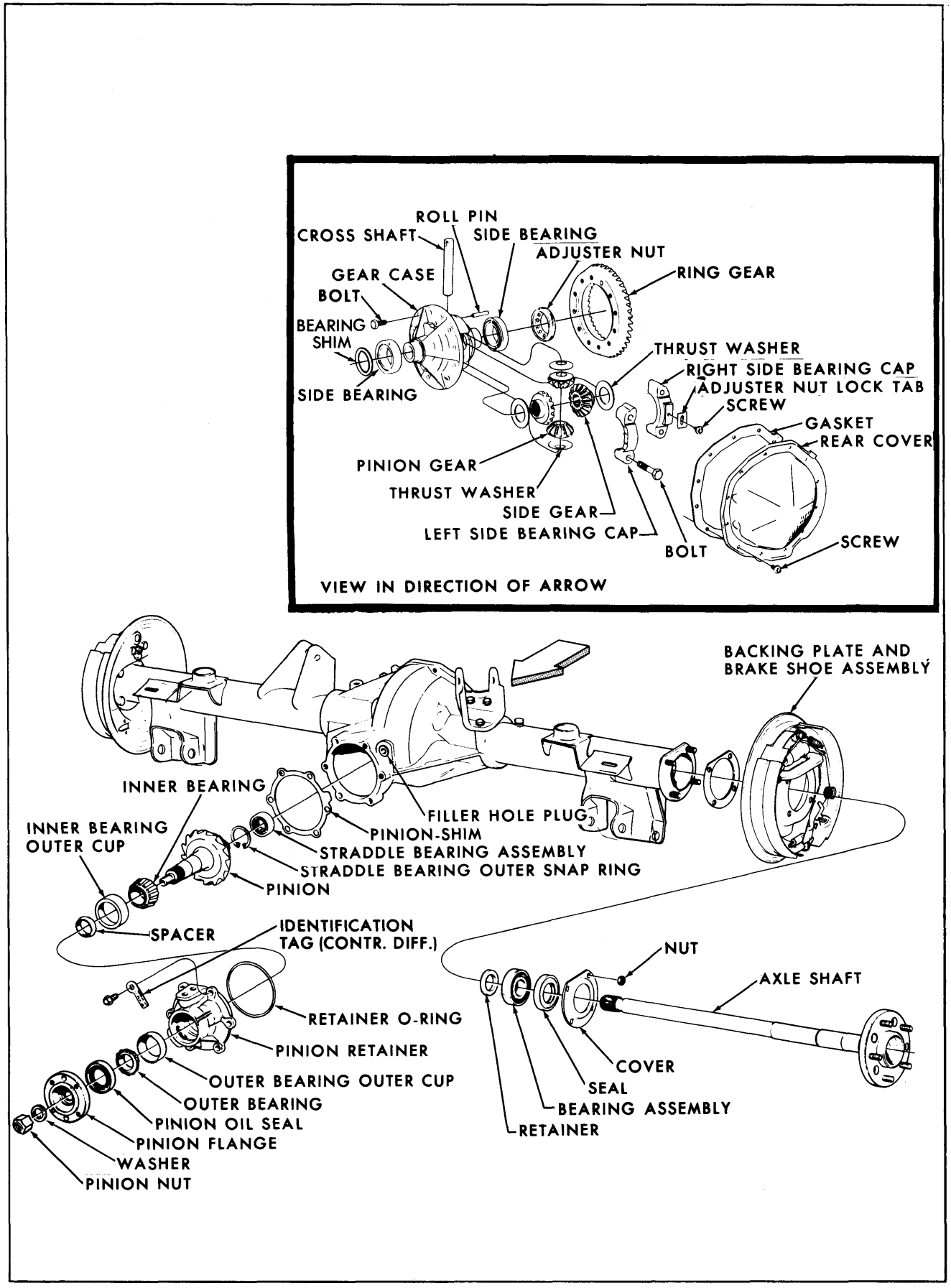


Fig. 4-55 Differential Carrier and Rear Axle

BACK TO INDEX

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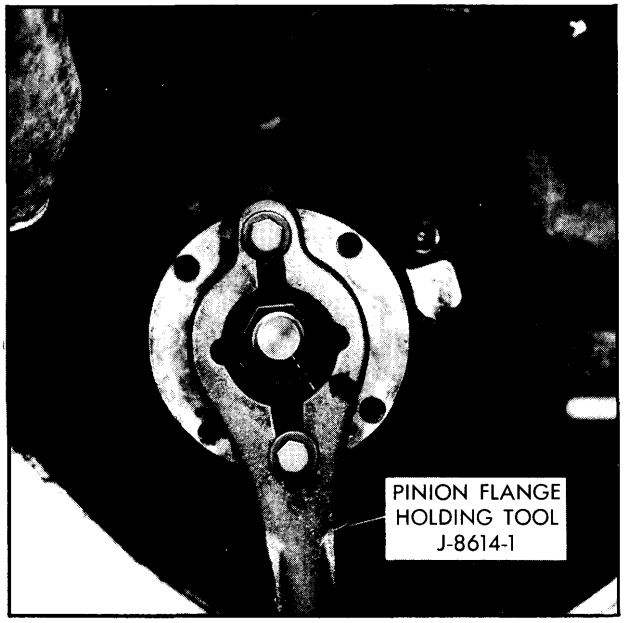


Fig. 4-57 Pinion Flange, Nut and Shaft Marking



Fig. 4-59 Removing Pinion Oil Seal

4. Install pinion flange holding Tool J-8614-1 with spacers J-21044-5 to pinion flange using 3/8" bolts.

5. Mark the position of the pinion flange, pinion shaft and nut so the proper pinion bearing pre-load can be maintained. Fig. 4-57.

6. Attach torque Multiplier, J-23410, to a 1-1/4" socket. Attach Torque Multiplier, J-23410, to Pinion Flange Holding Tool, J-8614-1, with Torque Multiplier Link, J-23413, Fig. 4-58.

7. Install breaker bar on torque multiplier and remove pinion nut and washer.

8. Install Pinion Flange Puller, J-8614-2, on pinion flange. This is done by screwing the puller on its bolt until it reaches the pointed end, then inserting pointed end into end of pinion shaft. Give puller a 1/8" turn. Holding puller stationary, turn bolt until wings of puller fit snugly into recesses of flange holding tool.

9. Tighten bolt until flange can be removed from pinion assembly.

10. Remove puller tools from flange.

11. Remove oil seal by driving it out of retainer with a blunt chisel, Fig. 4-59. Do not damage retainer.

b. Inspection

1. Examine seal surface of flange for tool marks, nicks, or damage, such as a groove worn by the seal. If damaged, replace flange.

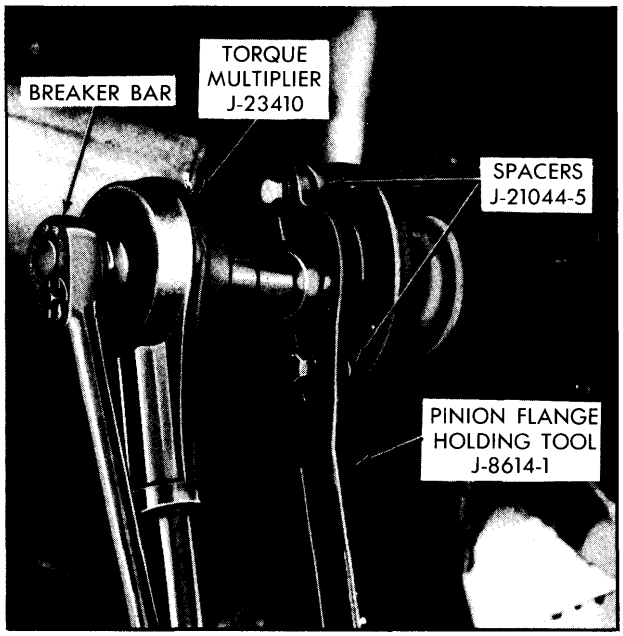


Fig. 4-58 Removing Pinion Nut

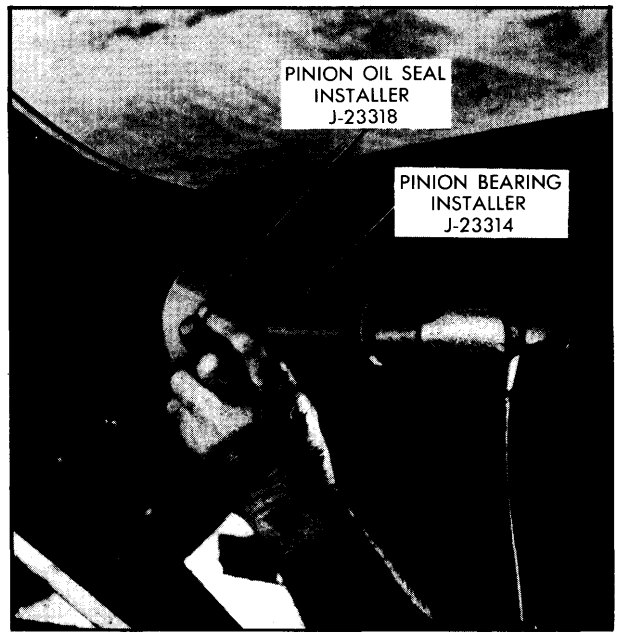


Fig. 4-60 Installing Pinion Oil Seal

BACK TO INDEX

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(NOTE: If flange is replaced remove retainer assembly. Replace collapse spacer, "O" Ring, and manually preload as described in Note 48 part L.)

2. Examine retainer bore and remove any burrs that might cause leaks around the O.D. of the seal.

c. Installation

1. Pack inner lip of new pinion oil seal with wheel bearing lubricant.
2. Position seal on retainer. Place oil seal installer J-23318 against seal, and bearing installer J-23314 against seal installer. Tap bearing in place with ball peen hammer, Fig. 4-60.
3. Install pinion flange on pinion shaft using alignment marks made on disassembly.
4. Install pinion washer and nut. Tighten nut only enough to remove bearing end play.

(NOTE: If flange did not slip on far enough to start nut and washer, tap gently with a soft hammer until nut can be started.)

5. Install Spacers, J-21044-5, over unthreaded holes in pinion flange.
6. Install Pinion Flange Holding Tool, J-8614-1, with raised side of tool against spacers. Secure holding tool with 3/8" bolts and nuts, Fig. 4-57.
7. Attach Torque Multiplier, J-23410, to 1-1/4" socket and install on pinion nut. Attach Torque Multiplier Link, J-23413, Fig. 4-58.
8. Install breaker bar on torque multiplier.
9. Tighten pinion nut 1/8" beyond alignment marks.

(NOTE: Refill with rear axle lube, Part No. 1050189, or equivalent, until fluid level is even with lower lip of filler hole.)

48. Differential Overhaul

a. Preparatory Steps

1. Position car on hoist.
2. Remove both rear wheel shields and wheel discs.
3. Loosen wheel mounting nuts on both rear wheels.
4. Raise car on hoist and place jack stands under rear frame cross member. Lower axle to improve access.

CAUTION: Never use control arms as contact points for hoist or jack stands, as damage may result.

5. Remove rear wheel mounting nuts and both rear wheels.
6. Remove push nuts securing brake drum to axle shaft bolts.
7. Remove brake drums.
8. Remove four nuts that secure retainers and backing plates to rear axle housing.
9. Attach Slide Hammer, J-2619,and Adapter, J-2619-4, to Axle Shaft Puller, J-21579.
10. Install Axle Shaft Puller, J-21579, on studs of rear axle shaft flange, Fig. 4-47.

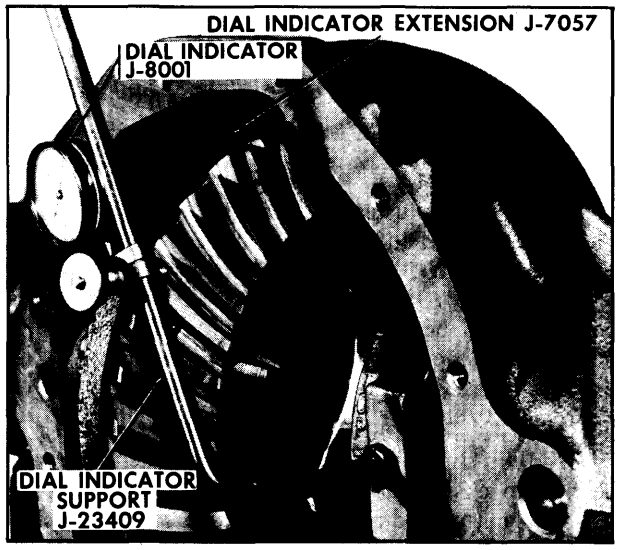


Fig. 4-61 Checking Pinion To Ring Gear Backlash

11. Drive outward with Slide Hammer to remove axle shaft. Remove both axle shafts in this manner.

(NOTE: The tapered roller unit type rear wheel bearing, when new, is bonded together to facilitate installation. If tapered roller unit bearing is used, the bearing may separate on axle shaft removal leaving the outer race in the axle housing. This is a normal condition and does not indicate failure. If the bearing is to be replaced, make sure the old bearing outer race is removed from the housing before installing a new bearing.)

12. Install two nuts on brake backing plate mounting studs to prevent backing plates from falling and damaging brake lines.

CAUTION: Brake lines must not be used to support the backing plate and brake shoe assembly as damage may result.

13. Remove two attaching screws and lockwashers that secure differential carrier nose bumper arm and remove nose bumper arm.
14. To preserve balance, scribe an alignment mark between propeller shaft rear flange and pinion flange for proper orientation on re-installation. (presence of hose clamps on rear of propeller shaft indicate that a field rebalancing procedure has been performed.)

Install wire or fan belt to support propeller shaft as shown in Fig. 4-30, then disconnect propeller shaft in the following manner.

a. Of the four universal joint flange attaching screws and lockwashers, remove the two that are most accessible.

b. Rotate propeller shaft to gain access to remaining two flange attaching screws and lockwashers.

c. Remove screws and lockwashers, separate flanges, and allow shaft to rest on wire or fan belt.

15. Place a drain pan under differential.
16. Loosen 12 differential cover to housing screws. Slide cover back on screws and allow lubricant to drain from differential.

BACK TO INDEX

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17. Remove 12 differential cover to housing screws and remove differential cover and gasket. Discard gasket.

CAUTION: Take care not to damage brake lines and hoses now and throughout procedure.

b. Backlash Check

1. Remove adjuster nut lock tab.
2. Using Dial Indicator, J-8001, and Dial Indicator Support, J-23409, determine and record ring gear to pinion backlash, Fig. 4-61. If original pinion and ring gear set is to be used on reassembly, and mileage is greater than approximately 3000, it is important to re-establish this exact backlash measurement on reassembly.

(NOTE: Indicator button should touch the ring gear tooth on face of drive side at heel. Angle between indicator button and tooth face must be 90°. Backlash is measured by rocking ring gear back and forth with pinion securely held. Take three readings evenly spaced around the ring gear. The readings should all fall between .005" and .010" and should not vary from each other by more than .003".)

3. Remove dial indicator and support from unit.

c. Tooth Pattern Check

1. Remove all but one of six pinion retainer to differential carrier screws. Loosen the remaining screw but do not remove at this time.
2. Install Guide Pins, J-23311.
3. Attach Slide Hammer, J-2619, to Pinion Puller, J-23324.

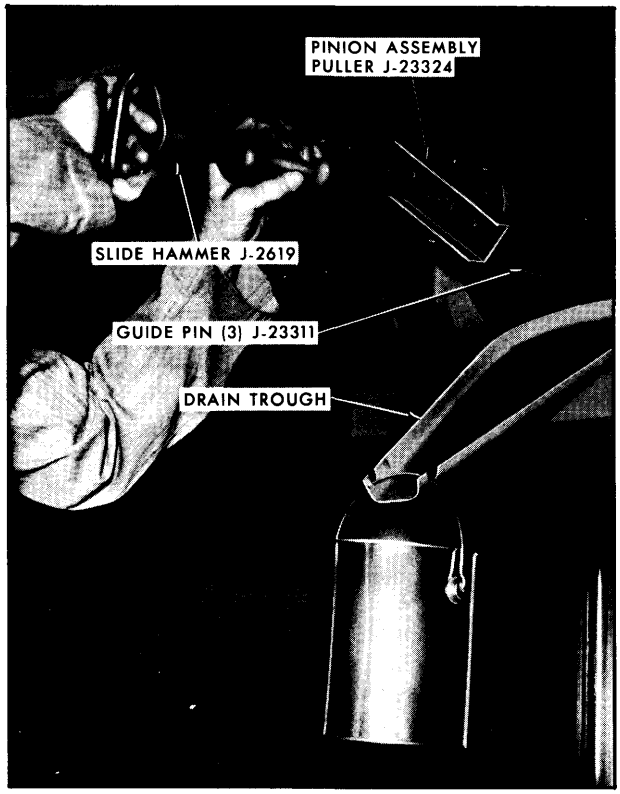


Fig. 4-62 Removing Pinion Assembly

4. Attach Pinion Puller, J-23324, to pinion flange, Fig. 4-62.
5. Using slide hammer, unseat pinion assembly from differential carrier, Fig. 4-62. Leave shim(s) in installed position.
6. Remove remaining screw, and slide pinion over guide pins and out of differential carrier.
7. Remove puller tools from pinion flange.
8. Clean ring gear teeth thoroughly with solvent and paint teeth with a light even coat of gear marking compound.

(NOTE: Wipe excess lube from pinion cavity in carrier as lube free teeth provide a better visual pattern.)

9. Clean pinion gear teeth thoroughly with solvent and re-install assembly in housing using three of six screws, tightening to 30 foot-pounds.
10. Turn ring gear manually one complete turn in each direction, using a box end wrench on the ring gear to case bolts. During this operation, hold a shop cloth around the pinion flange and grip firmly so that additional effort is required to turn ring gear, Fig. 4-63. This load assures clarity and accuracy of tooth pattern.
11. Compare pattern to samples in Tooth Pattern Chart, Fig. 4-64, to determine whether shim change is required. See effect of shim change in Fig. 4-65.

d. Bench Check of Pinion Flange Runout

1. Remove pinion assembly from housing by following procedure in Note 48d, Steps 1 through 7.
2. Remove pinion shim from carrier and remove and discard pinion retainer O-ring.
3. Install pinion retainer in Holding Fixture, J-23320, Fig. 4-66.
4. Using a wire brush, clean pinion flange face thoroughly.

(NOTE: Heavy scale may have to be cleaned with carbon scraper. Never use a file on any area of the flange. If rust cannot be removed from pinion flange face, replace flange. Inspect flange face for damage or burrs. If either of these conditions exist, flange must be replaced. Clean propeller shaft rear flange also, to facilitate re-installation.)

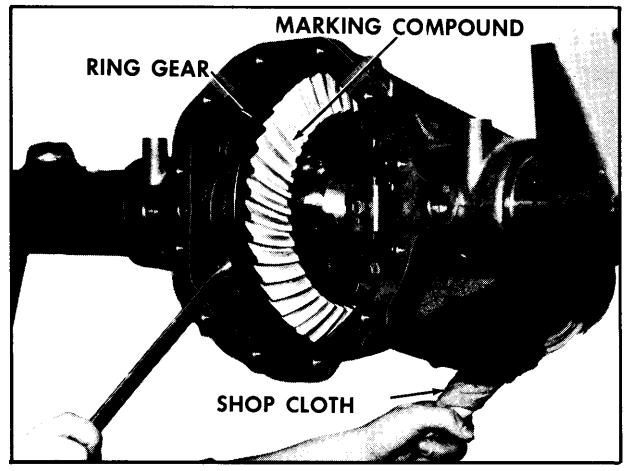


Fig. 4-63 Obtaining Tooth Pattern

BACK TO INDEX

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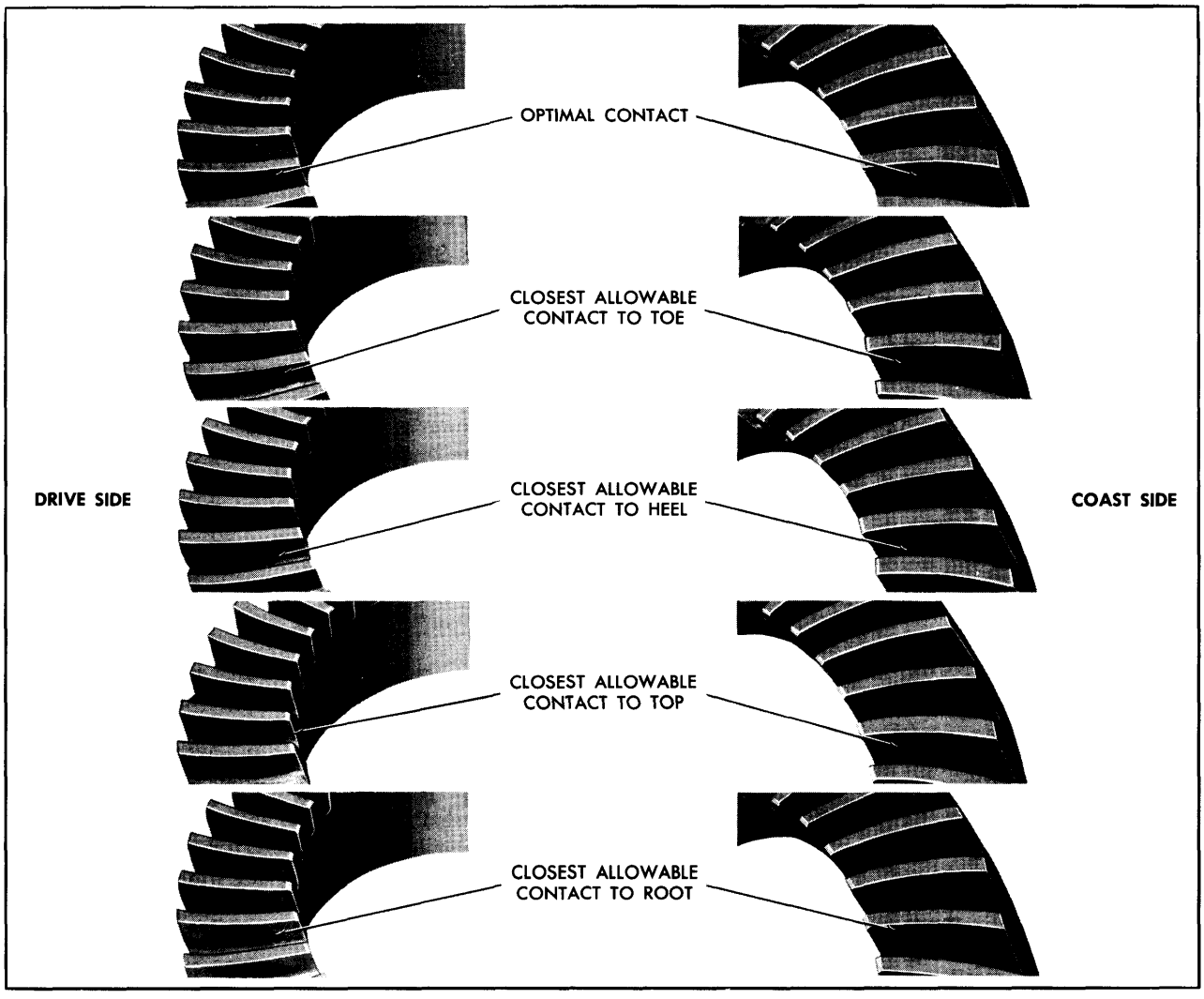


Fig. 4-64 Tooth Pattern Chart

5. Remove one pinion retainer screw from holding fixture and install Dial Indicator, J-8001, and Support, J-6126, so that indicator touches flange between bolt holes and pilot diameter at a 90° angle, Fig. 4-67. Set dial to zero.

6. Rotate pinion flange one complete revolution in each direction and record maximum face runout reading.

7. Attach Dial Indicator Extension, J-7057, and reposition dial indicator so that stem touches side of pinion flange pilot diameter, Fig. 4-68.

8. Repeat Step 6 to find radial runout. Combined face and radial runout should not exceed .005".

e. Pinion Disassembly

The differential ring gear and pinion are serviced as a matched set. In the event that one or the other becomes damaged, both the ring gear and pinion must be replaced.

1. Determine preload of pinion assembly using a 50 inch-pound torque wrench and a 1-1/4" socket. Turn pinion two revolutions in each direction and, disregarding torque required to begin turning pinion, record maximum reading to be used at time of reassembly in Note 48 1, Step 23c.

WARNING: FAILURE TO EMPLOY RETAINING BAG J-23320-1, AS DIRECTED IN THE FOLLOWING STEP AND THROUGHOUT PROCEDURE MAY CAUSE DAMAGE TO PARTS AND MAY ALSO RESULT IN SERIOUS PERSONAL INJURY. EVEN WITH BAG INSTALLED, BE CERTAIN TO KEEP FEET AWAY FROM DIRECTLY UNDER PINION ASSEMBLY.

2. Install Retaining Bag, J-23320-1, on Holding Fixture, J-23320, Fig. 4-69.

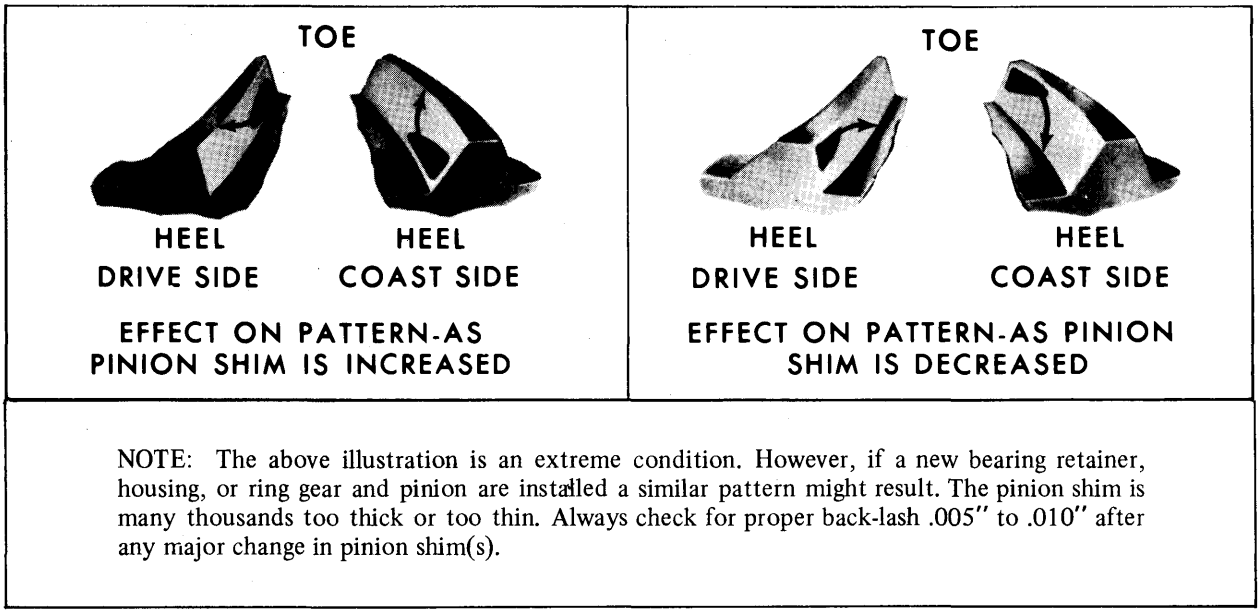
3. Install Spacers, J-21044-5, over unthreaded holes in pinion flange, Fig. 4-69.

4. Install Pinion Flange Holding Tool, J-8614-1, with raised side of tool against spacers. Secure holding tool with two 3/8-inch bolts and nuts, Fig. 4-69.

5. Attach Torque Multiplier, J-23410, to a 1-1/4" socket. Attach Torque Multiplier, J-23410, to Pinion

BACK TO INDEX

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NOTE: The above illustration is an extreme condition. However, if a new bearing retainer, housing, or ring gear and pinion are installed a similar pattern might result. The pinion shim is many thousands too thick or too thin. Always check for proper back-lash .005" to .010" after any major change in pinion shim(s).

Fig. 4-65 Shim Changes on Tooth Pattern—Maintaining Correct Backlash

Flange Holding Tool, J-8614-1, with Torque Multiplier Link, J-23413, Fig. 4-69.

6. Install breaker bar on torque multiplier and remove pinion nut and washer.

7. Scribe or punch an alignment mark to align pinion shaft splines to pinion flange splines on reassembly.

8. Install Pinion Flange Puller, J-8614-2, on pinion flange, Fig. 4-70. This is done by screwing the puller on its bolt until it reaches the pointed end, then inserting pointed end into end of pinion shaft. Give puller a 1/8 turn. Holding puller stationary, turn bolt until wings of puller fit snugly into recesses of flange holding tool.

9. Tighten bolt until flange can be removed from pinion assembly, fig. 4-70.

(NOTE: Pinion may fall into retaining bag when flange is removed.)

10. Remove puller tools from flange.

(NOTE: If pinion did not fall into retaining bag, tap pinion shaft several times with a soft hammer. If this fails, place a block of wood on shaft and, supporting pinion from under retaining bag with one hand, use a heavy ball peen hammer to separate pinion from retainer.)

11. Remove retaining bag and pinion from holding fixture being careful not to drop pinion.

12. Pry pinion oil seal from retainer, using care so as not to damage inner surface of retainer, Fig. 4-71.

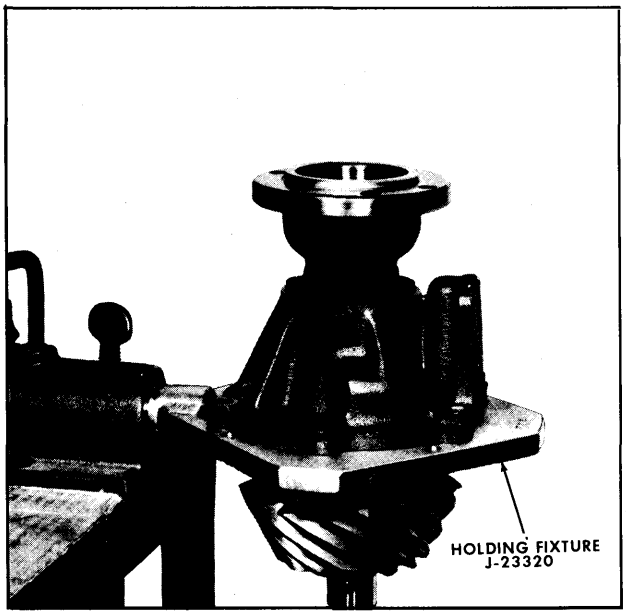


Fig. 4-66 Pinion Assembly In Holding Fixture

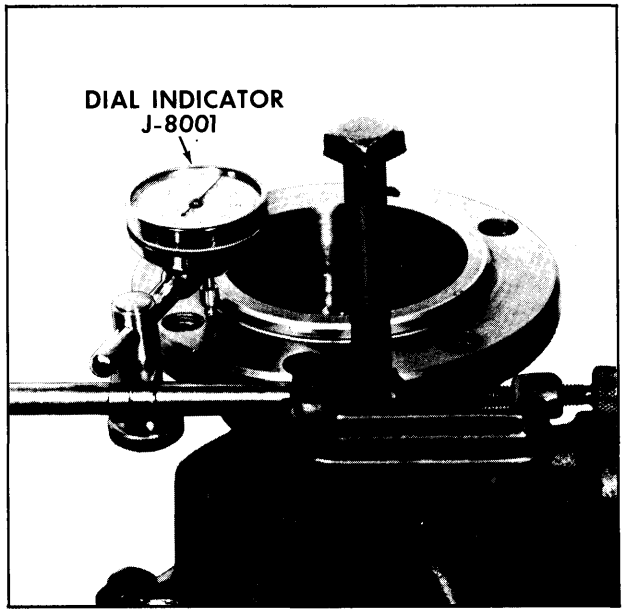


Fig. 4-67 Checking Pinion Flange Face Runout

BACK TO INDEX

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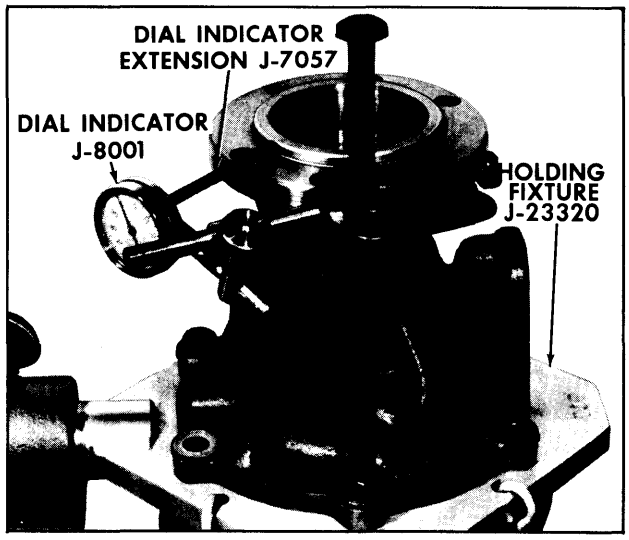


Fig. 4-68 Checking Pinion Flange Radial Runout

13. Remove outer bearing from retainer.
14. Remove collapse spacer from pinion shaft and discard spacer.
15. Install Bearing Plate, J-23399-1, on pinion and both halves of Bearing Puller, J-23399-2, Fig. 4-72.
16. Position Puller Bar, J-8433-1, on top of pinion shaft. Then, using two Bolts, J-23399-4, attach puller bar to bearing plate, Fig. 4-72.
17. Place assembly in vise, Fig. 4-72. With one hand on pinion gear teeth, tighten large center bolt on puller bar until pinion inner bearing is removed.
18. Attach Universal Handle, J-8092, to Pinion Outer Bearing Outer Cup Remover, J-23671.

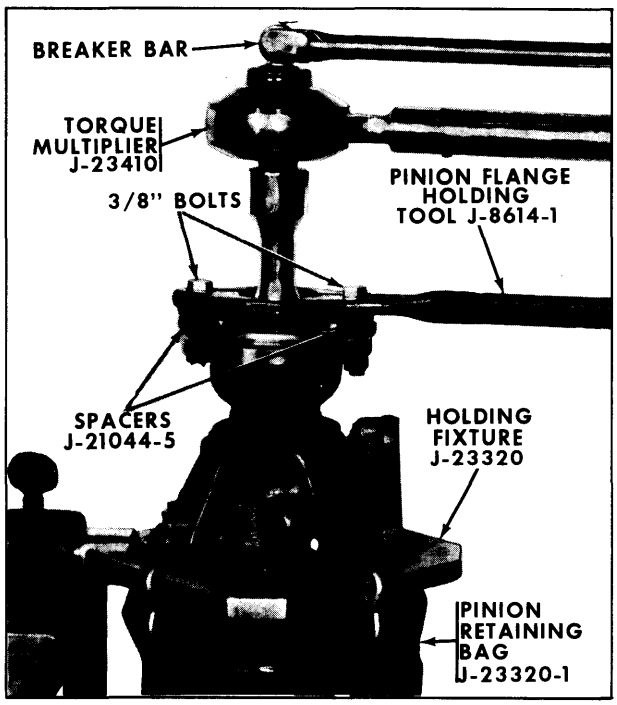


Fig. 4-69 Removing and Installing Pinion Nut

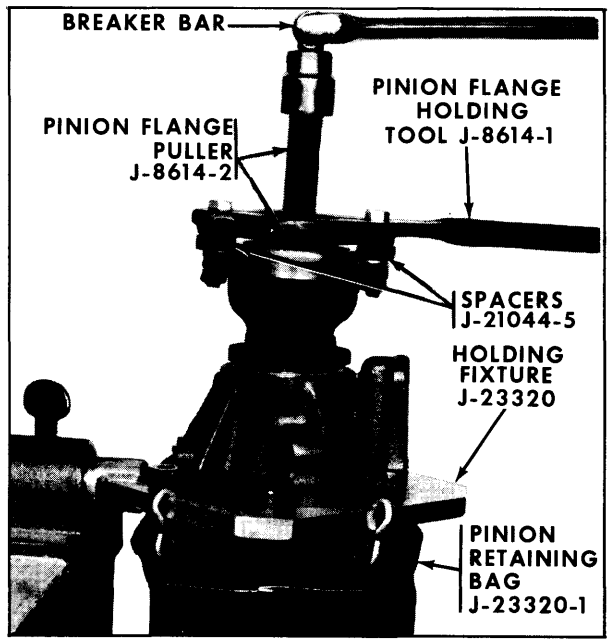


Fig. 4-70 Removing Pinion Flange

19. Install Pinion Outer Bearing Outer Cup Remover, J-23671, in retainer Fig. 4-73.

(NOTE: When installing remover, it will be necessary to slide one end of tool into oil passage in retainer. Then slide tool into position to remove outer bearing cup.)

20. Place retainer in arbor press and carefully press outer bearing cup from retainer.
21. Remove Universal Handle, J-8092, from Pinion Outer Bearing Outer Cup Remover, J-23671, and install it in raised side of Pinion Inner Bearing Outer Cup Remover, J-23321.
22. Turn retainer over in press and install bearing cup remover in retainer, Fig. 4-74.

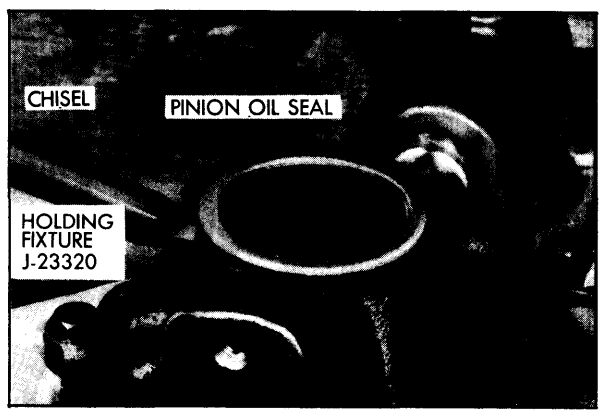


Fig. 4-71 Removing Pinion Oil Seal

BACK TO INDEX
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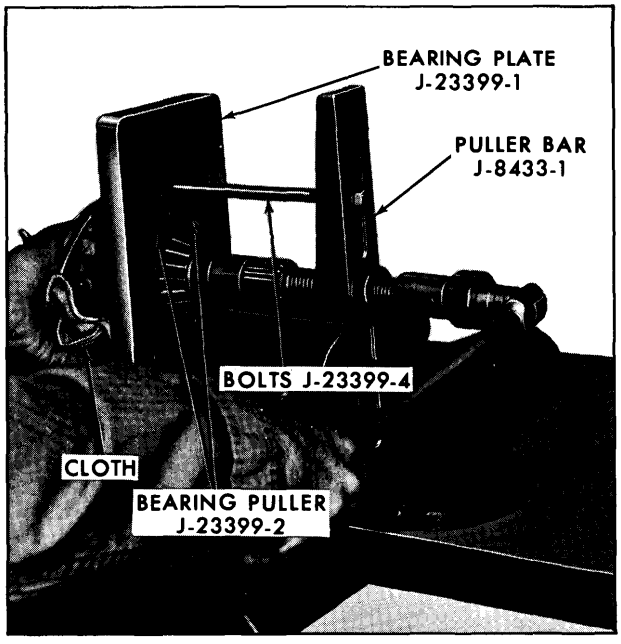


Fig. 4-72 Removing Pinion Inner Bearing

23. Carefully press inner bearing outer cup from retainer.

f. Cleaning and Inspection of Pinion Assembly Components

1. Clean all parts with cleaning solvent.
2. Inspect all parts for nicks, wear, or cracks.

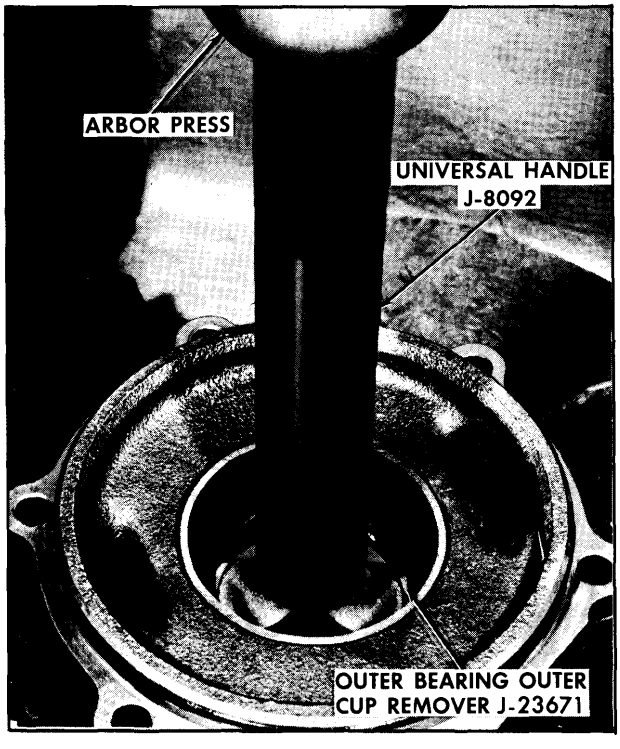


Fig. 4-73 Removing Outer Bearing Outer Cup



Fig. 4-74 Removing Inner Bearing Outer Cup

g. Checking Cap Spread and Removing Gear Case Assembly

1. Install Dial Indicator, J-8001, Dial Indicator Support, J-23409, and Plate, J-23409-1, as shown in Fig. 4-75. Indicator should make firm contact with plate and a 90° angle with plate. Set dial indicator to zero.
2. Loosen but do not remove mounting bolts securing left bearing cap to carrier.

(NOTE: Use extreme care to avoid disturbing dial indicator, support, or plate when loosening mounting bolts.)

3. Loosen adjuster nut, using Spanner Wrench, J-23398, until tension on adjuster nut is released.

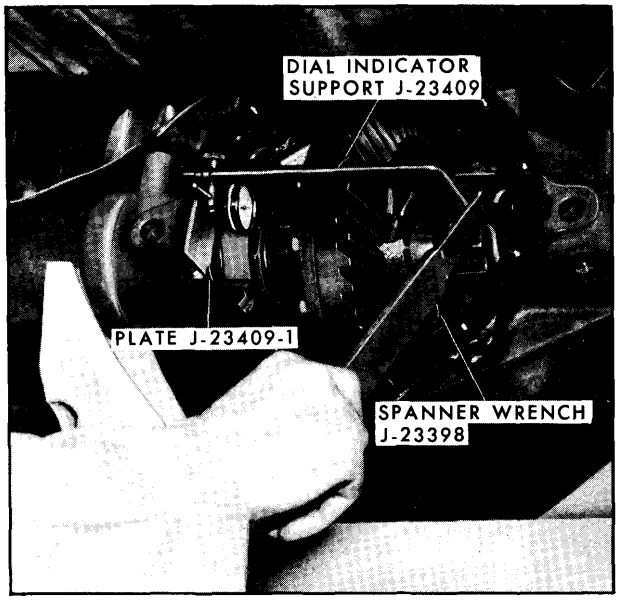


Fig. 4-75 Obtaining Cap Spread

BACK TO INDEX

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Fig. 4-76 Removing and Installing Gear Case

4. Record reading from dial indicator and remove indicator, support, and plate from carrier.
5. Remove both bearing caps.
6. Remove adjuster nut.
7. Slide gear case to right to remove differential shim.
8. Remove differential gear case from carrier housing. Fig. 4-76.

CAUTION: Use extreme care to prevent differential side bearing outer cups from dropping when gear is removed, resulting in damage to parts.

h. Gear Case Diasassembly

(NOTE: When working with Controlled Differential, skip Parts i, j, and o of Note 48, and perform the equivalent procedure of Note 50. The differential ring gear and pinion are serviced as a matched set. In the event one or the other becomes damaged, both the ring gear and pinion must be replaced.)

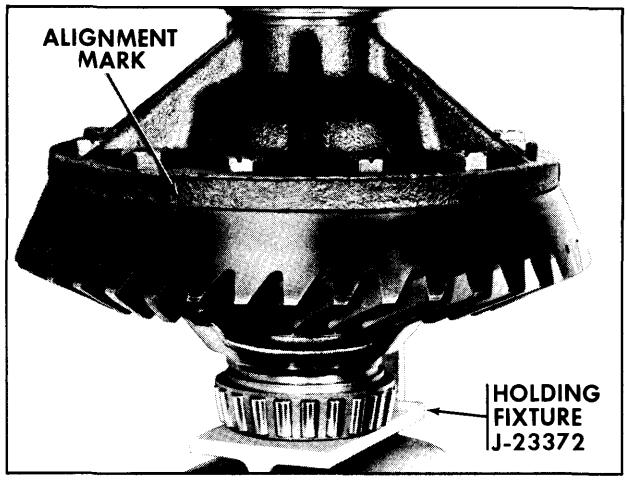


Fig. 4-77 Position of Gear Case on Holding Fixture

1. Install Differential Case Holding Fixture J-23372, in vise, and position differential case on holding tool, Fig. 4-77.
2. Scribe an alignment mark on differential case and ring gear.
3. Loosen 12 ring gear to case bolts.

(NOTE: These bolts have left hand threads.)

4. Remove only three of the twelve bolts and install Guide Pins, J-23316-1.
5. Remove gear case from holding tool and place on

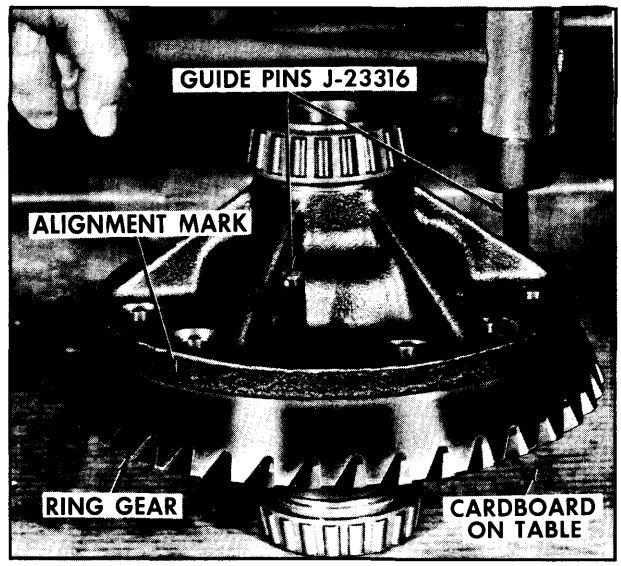


Fig. 4-78 Removing Ring Gear From Gear Case

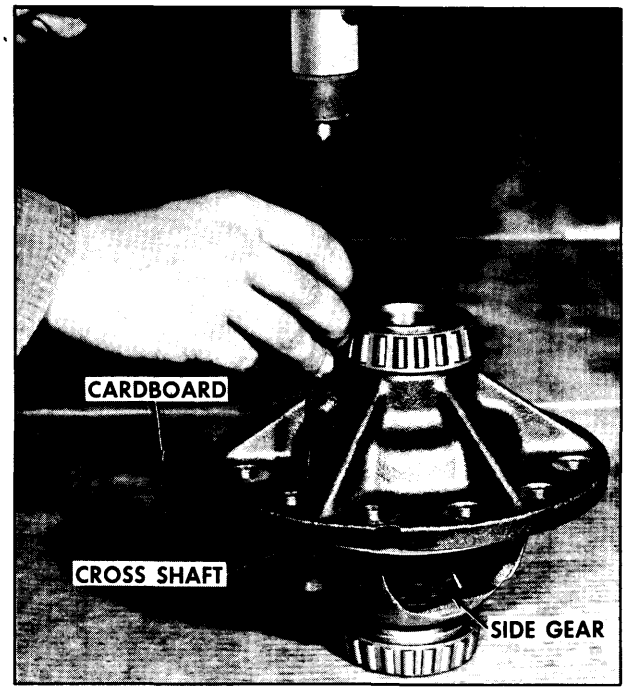


Fig. 4-79 Removing Cross Shaft Roll Pin

BACK TO INDEX

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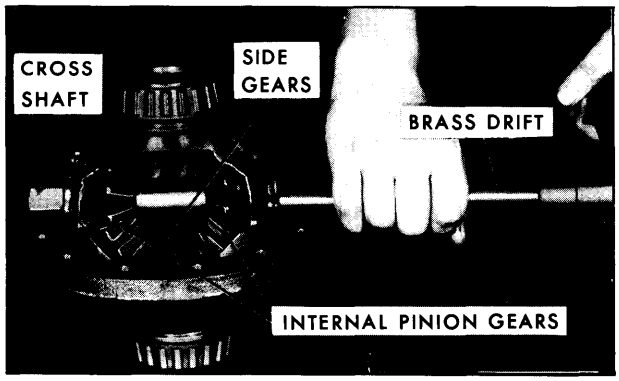


Fig. 4-80 Removing Cross Shaft

table covered with cardboard, with ring gear facing downward.

6. Remove remaining nine bolts.

7. Tap on guide pins to unseat and remove ring gear, Fig. 4-78.

8. Using a 1/4" diameter pin punch, remove differential cross shaft pin, Fig. 4-79.

9. Using a brass rod, remove differential cross shaft, Fig. 4-80.

10. Rotate pinion gear until gears align with opening in differential, Fig. 4-81.

11. Remove one differential pinion gear and thrust washer through opening in gear case.

(NOTE: When removing differential pinion gear, place one hand inside differential case and hold side gear to prevent it from falling in case.)

12. Remove remaining differential pinion gear and thrust washer.

13. Remove both side gears and thrust washers, Fig. 4-81.

14. Install Pilot, J-23406, on differential side bearing, Fig. 4-82.



Fig. 4-81 Removing and Installing Internal Gears

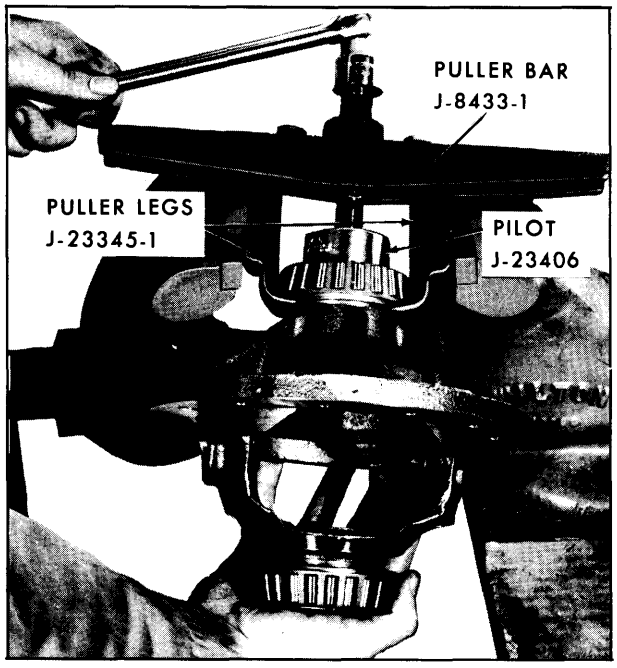


Fig. 4-82 Removing Differential Side Bearings

15. Install Puller Legs, J-23345-1, and Puller Bar, J-8433-1, on side bearing and secure assembly in vise, Fig. 4-82.

16. Tighten driver bolt and remove side bearing.

CAUTION: Side bearing and gear case will fall when bearing is removed. If possible, swing vise so that gear case is over the bench. Even a short drop may damage these parts. For this reason, place a piece of thick cardboard on bench. If these safety precautions cannot be followed, grip gear case firmly when removing side bearing.

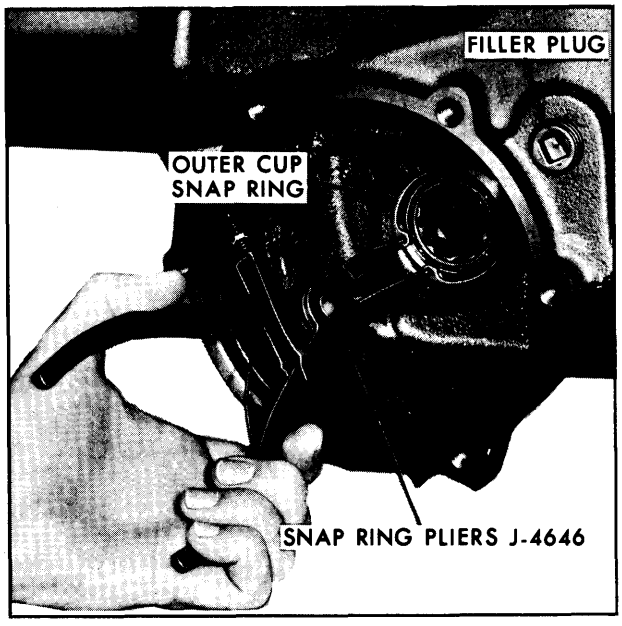


Fig. 4-83 Removing and Installing Straddle Bearing Outer Snap Ring

BACK TO INDEX

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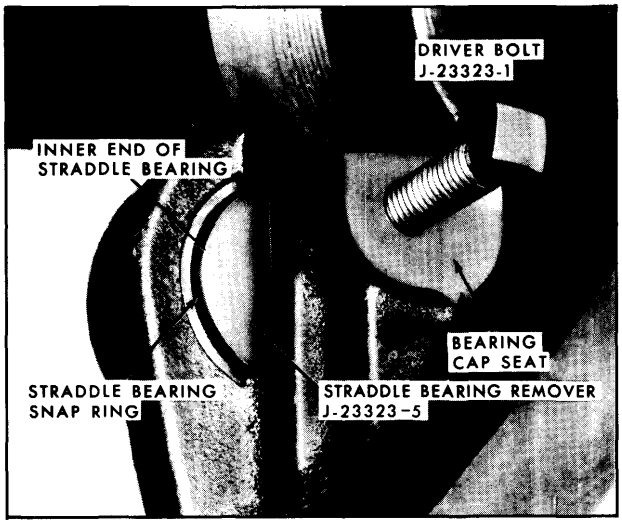


Fig. 4-84 Removing Straddle Bearing

(NOTE: When removing side bearing, be sure to check position of puller legs several times. Puller legs must remain positioned under side bearing inner race.)

17. Repeat Steps 14, 15, and 16 to remove other side bearing.

i. Cleaning and Inspection of Gear Case Assembly

1. Wash all parts in solvent or mineral spirits.
2. Using a clean cloth, wipe inside of axle housing and differential carrier clean.
3. Dry all parts thoroughly.
4. Visually inspect all parts for chips, nicks, or excessive wear.

j. Straddle Bearing Removal

1. Using Snap Ring Pliers, J-4646, remove straddle bearing outer snap ring, Fig. 4-83.

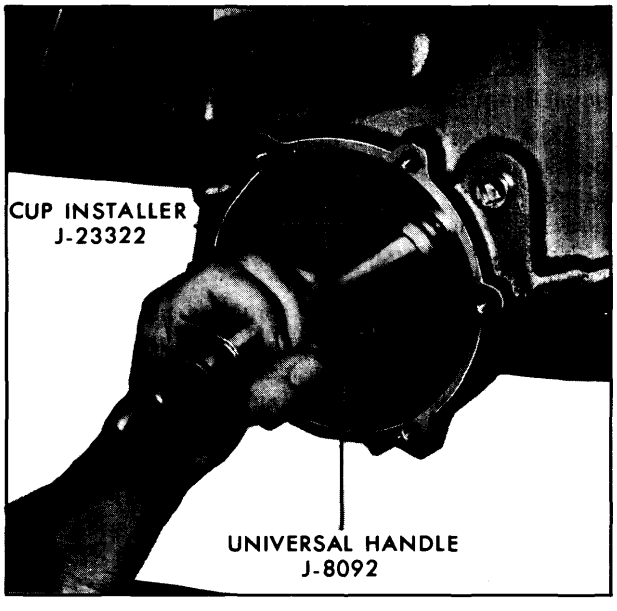


Fig. 4-85 Installing Straddle Bearing Assembly

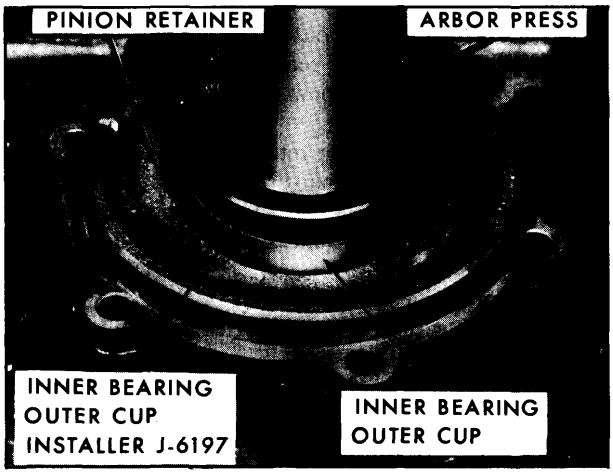


Fig. 4-86 Installing Inner Bearing Outer Cup

2. Install Straddle Bearing Remover, J-23323-5, Fig. 4-84, centering remover on bearing.
3. Install Driver Bolt, J-23323-2, in bearing cap mounting bolt hole, Fig. 4-84.
4. Tighten driver bolt and remove straddle bearing assembly.

k. Straddle Bearing Installation

1. Attach Universal Handle, J-8092, to Bearing Installer, J-23322, and install straddle bearing and outer race assembly, Fig. 4-85.
2. Using Snap Ring Pliers, J-4646, install outer snap ring to secure straddle bearing outer race in differential carrier, Fig 4-83.

l. Pinion Assembly

1. Position inner bearing outer cup and Inner Bearing Outer Cup Installer, J-6197, on pinion retainer. Using arbor press, install inner bearing outer cup into retainer, Fig. 4-86.
2. Remove cup installer, and turn retainer over in press.
3. Position outer bearing outer cup and Outer Bearing Outer Cup Installer, J-8611, on retainer. Press outer bearing outer cup into retainer, Fig. 4-87.

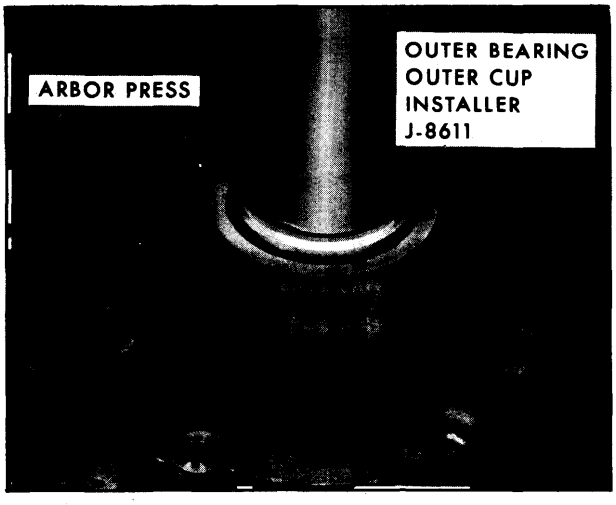


Fig. 4-87 Installing Outer Bearing Outer Cup

BACK TO INDEX

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4. Lubricate pinion outer bearing with differential lubricant and install outer bearing in retainer.

5. Pack inner lip of new pinion oil seal with wheel bearing lubricant.

6. Position oil seal on retainer, Fig. 4-88. Place Oil Seal Installer, J-23318, against seal.

7. Carefully press oil seal into pinion retainer.

8. When properly installed, oil seal should protrude approximately 1/16".

9. Remove oil seal installer.

10. Apply a light coat of differential lubricant on pinion inner bearing.

11. Using Bearing Installer, J-23314, and arbor press, install inner bearing on pinion shaft, Fig. 4-89.

12. Remove pinion shaft from press.

13. Install a new collapse spacer on pinion shaft.

14. With pinion shaft and retainer on bench, insert pinion shaft through retainer and position pinion flange on shaft using alignment marks made on disassembly.

15. Install pinion nut washer and pinion nut and tighten with fingers.

(NOTE: If flange did not slip on far enough to start nut and washer, tap gently with a soft hammer until nut can be started.)

16. Install Spacers, J-21044-5, over unthreaded holes in pinion flange.

17. Install Pinion Flange Holding Tool, J-8614-1, with raised side of tool against spacers. Secure holding tool with 3/8" bolts and nuts, Fig. 4-69.

18. Attach Torque Multiplier, J-23410, to 1-1/4" socket and install on pinion nut. Attach Torque Multiplier Link, J-23413, Fig. 4-69.

19. Install breaker bar on torque multiplier.

20. Tighten pinion nut only until all end play has been removed.

21. Remove breaker bar, torque multiplier and link, holding tool, bolts, nuts, and spacers and check flange runout as follows:

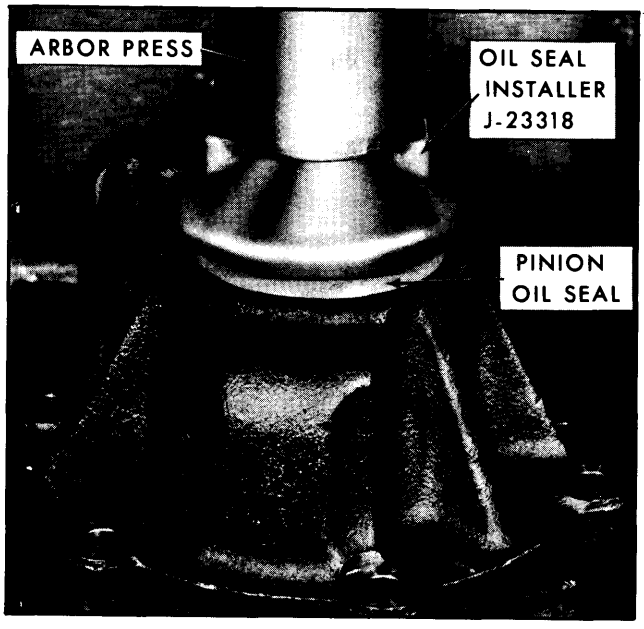


Fig. 4-88 Installing Pinion Oil Seal

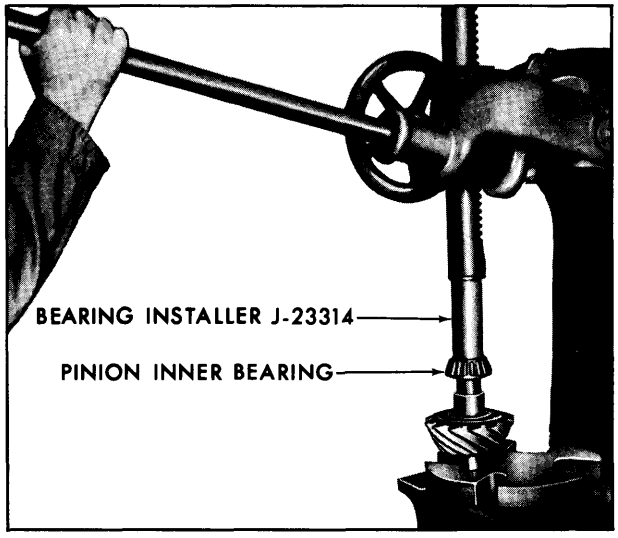


Fig. 4-89 Installing Pinion Inner Bearing

a. Remove one pinion retainer screw from holding fixture and install Dial Indicator, J-8001, and Support J-6126 so that stem touches flange between bolt holes and pilot diameter at a 90° angle, as shown in Fig. 4-67. Set dial to Zero.

b. Rotate pinion flange one complete revolution in each direction and note maximum reading obtained for face runout.

c. Install Dial Indicator Extension, J-7057, on dial indicator, and reposition indicator so that stem touches side of pinion flange pilot diameter, Fig. 4-68.

d. Rotate pinion flange one complete turn in each direction. Note maximum radial runout. If combined face and radial runout is .005" or less, proceed to Step 23.

22. If combined runout exceeds .005" remove and re-index pinion flange 90° from its original position on pinion shaft splines. Install pinion nut and washer until end play is removed and recheck runout. If runout still exceeds specification, remove and re-index 180° and check runout. If runout is still unacceptable, replace pinion flange and check runout of new flange.

23. After end play is removed, and runout is within specification, build preload in the pinion by the following procedure:

a. Tighten pinion nut no more than 1/8 of a flat.

b. Remove torque wrench, torque multiplier and torque multiplier link.

c. Insert 50 inch-pound torque wrench and 1-1/4 inch socket on pinion nut and turn two revolutions in each direction. If new bearings are installed, preload reading should be 22-30 inch-pounds. If original bearings are used, set preload to 5 inch-pounds more than original reading, as obtained in Step e-1, but not more than 15 inch-pounds total.

d. If reading is under these specifications, continue tightening, but never tighten more than 1/8 of a flat without checking preload.

CAUTION: After end play has been removed, preload will build very quickly. If the preload

BACK TO INDEX

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specification is exceeded, it will be necessary to disassemble the pinion again, and install another new collapse spacer. Never back off pinion nut to gain the proper preload.

24. After proper preload reading is obtained, remove all tools from pinion assembly.

m. Installation of Pinion Assembly

1. Install original shim(s) over guide pins in differential carrier.
2. Using differential lubricant, Part No. 1050189 or equivalent, lubricate a new O-ring and install O-ring on pinion retainer.
3. Slide pinion assembly over guide pins and into differential carrier.
4. Install three pinion retainer to differential carrier screws finger tight.
5. Remove guide pins and install remaining three screws. Tighten all six screws alternately to 30 foot-pounds.

n. Assembly of Gear Case

1. Apply a light coat of differential lubricant, Part No. 1050189, or equivalent, to all differential gears.
2. Install one side gear and thrust washer in gear case, Fig. 4-81.
3. Install remaining side gear and thrust washer, Fig. 4-81.

(NOTE: Hold gear and thrust washer in installed position.)

4. Install one pinion gear and thrust washer in each gear case opening, Fig. 4-81.
5. Rotate differential pinion gears and thrust washers so that cross shaft holes align with cross shaft opening in gear case, Fig. 4-80.
6. Slide Side Gear Aligning Pin, J-23310, through differential gears and thrust washers to align gears and washers, Fig. 4-90.
7. Install differential cross shaft and align hole in cross shaft with roll pin hole in differential gear case, Fig. 4-91.



Fig. 4-90 Aligning Internal Gears and Thrust Washers

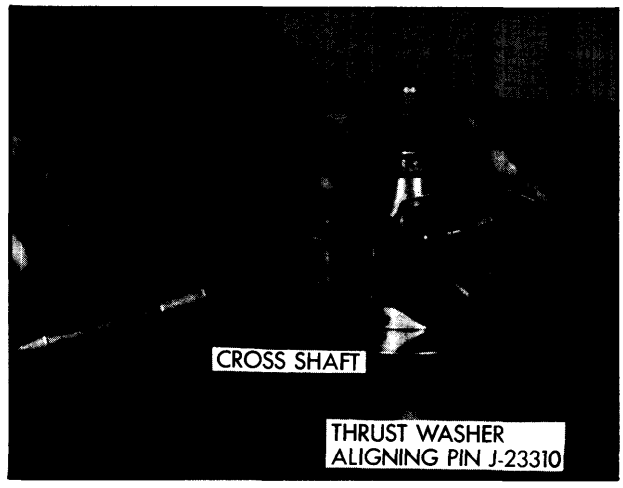


Fig. 4-91 Installing Cross Shaft

8. Install roll pin on counterbore side of roll pin opening with a 1/4" diameter punch until top of roll pin aligns with bottom of counterbore.
9. Install Guide Pins, J-23316-1, in ring gear.
10. Using alignment marks made on disassembly, align ring gear with gear case and position ring gear on case.
11. Install nine ring gear to differential gear case bolts finger tight.

(NOTE: These bolts have left hand threads.)

12. Using a soft mallet, tap ring gear down onto gear case.
13. Remove guide pins and install remaining three bolts.
14. Install differential gear case on Holding Fixture J-23372, Fig. 4-77.
15. Alternate tightening ring gear bolts to 85 foot-pounds.
16. Position one side bearing and Side Bearing Installer, J-23317, on gear case, Fig. 4-92.

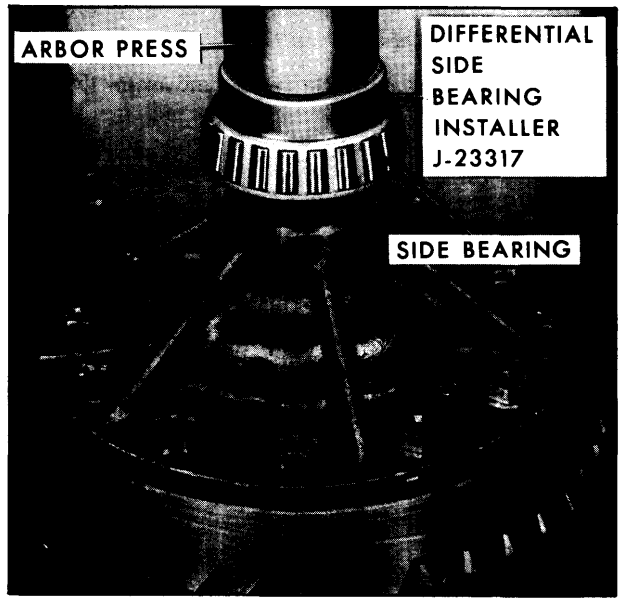


Fig. 4-92 Installing Side Bearings

BACK TO INDEX

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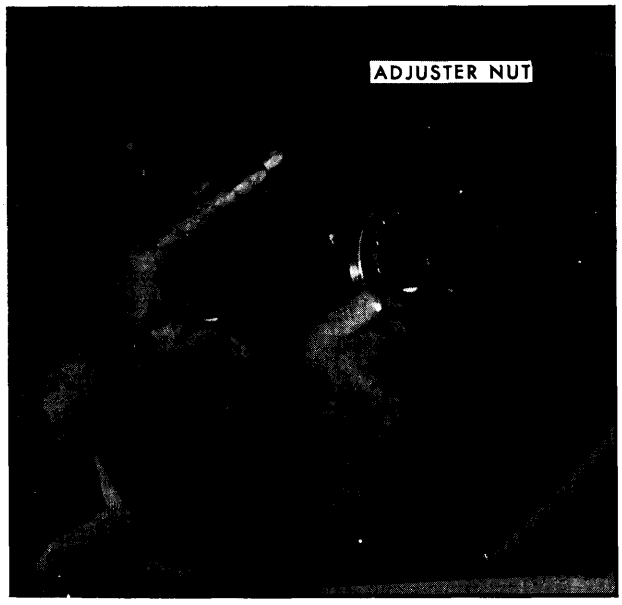


Fig. 4-93 Installing Adjuster Nut

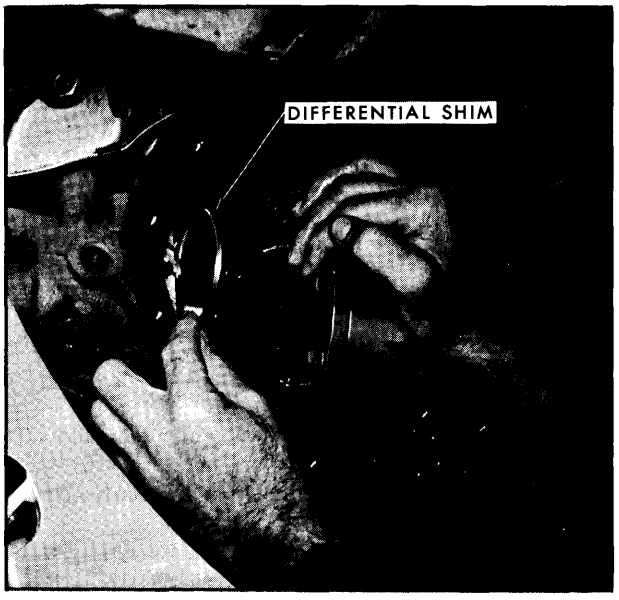


Fig. 4-94 Installing Side Bearing Shim

17. Use arbor press to install side bearing.

18. Repeat Steps 16 and 17 to install remaining side bearing.

o. Gear Case Installation

1. Install bearing cups on differential side bearings. Cups will have to be held in place when installing gear case into carrier, Fig. 4-76.

(NOTE: Make sure wider bearing cup is installed in differential left side bearing, which is the shim side of the unit.)

2. Install gear case assembly into differential carrier.

3. Install differential case adjuster nut, Fig. 4-93.

CAUTION: Make sure adjuster nut threads are properly aligned with threads in differential carrier, as damage may result.

4. Install right side bearing cap and install two cap mounting bolts. Do not tighten bolts at this time.

5. Align bearing cap threads with adjuster nut threads by pulling cap straight back on mounting bolts and then gently pushing cap forward and into position.

(NOTE: Bearing cap and adjuster nut threads are properly aligned when bearing cap and carrier shoulder are flush. Adjuster nut should turn freely.)

6. Tighten bolts finger tight to keep cap seated.

7. Slide differential gear case to extreme right so that ring gear and pinion gear teeth are fully engaged. Adjuster nut should not be contacting the right hand bearing cup.

8. Slide left side bearing and cup to right and insert largest side bearing shim, which will freely slide into place. (Start with original shim). Place beveled side of shim to left, Fig. 4-94.

9. Install left bearing cap and lightly tighten mounting bolts.

10. Tighten right bearing cap bolts to 50 ft. lbs.

11. Obtain proper bearing preload by the following procedure:

a. Install Dial Indicator, J-8001, and Tools J-23409-1 and J-23409-2 on differential carrier, Fig. 4-75.

b. Position button on indicator so that it rests against inside face of Plate, J-23409-2, then set dial to zero.

c. Using Spanner Wrench, J-23398, tighten adjuster nut until reading of .003" to .004" is obtained. Rotate ring gear at least one complete revolution. If cap spread reading has fallen, resume tightening adjuster nut until reading of .003" to .004" is obtained. Rotate and tighten as necessary until continuous reading within these specifications is attained.

d. Tighten left bearing cap mounting bolts to 50 ft. lbs.

(NOTE: Do not hit or bump dial indicator during this step. If indicator is disturbed in any way, adjuster nut must be backed off and procedure must be repeated.)

12. Reposition dial indicator and check ring gear to pinion backlash, Note 48c, Step 2, and Fig. 4-61.

(NOTE: Original backlash reading must be duplicated on any ring and pinion gear set that has been in use more than approximately 3000 miles. Backlash of from .006" to .008" should be obtained on lower mileage gear sets. If reading is too high, increase shim size. If reading is too low, decrease shim size. A .002" shim change will generally change backlash by .001". Recheck backlash after each shim change. If variation between three backlash readings evenly spaced around the ring gear exceeds .003", correct this condition by following procedure in Note 49 before proceeding to Step. 13.)

13. Ring gear and pinion teeth must be clean and

BACK TO INDEX

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free of oil to obtain correct tooth contact pattern. Paint all ring gear teeth with a light even coat of gear marking compound. Obtain tooth pattern by rotating ring gear at least one revolution in each direction, using a box end wrench on the ring gear bolts. Put a load on the pinion assembly during this operation by wrapping a shop cloth around pinion flange and holding cloth tightly. Compare pattern with samples, Fig. 4-64.

(NOTE: The Tooth Pattern Chart is designed to show the perfect tooth contact pattern and the minimum allowable distances between the pattern obtained and the four edges of each tooth. Patterns of both drive and coast sides of gear teeth must fall within the areas indicated. If either drive or coast pattern falls closer to an edge than any of the samples, pinion shim change is required.)

An increase in the thickness of the pinion shim, Fig. 4-65, moves the drive side pattern from the root of the toe toward the top of the heel; the coast pattern moves from the root of the heel toward the top of the toe. A decrease in the thickness of the pinion shim moves the drive side pattern from the top of the heel toward the root of the toe; the coast pattern moves from the top of the toe toward the root of the heel.

(NOTE: Pinion shim changes also change the amount of backlash. The above directional moves are dependent on maintaining .006" to .008" backlash.)

Although 21 different size shims are used in production, only three sizes are provided for service use: .010", .007", and .006". Used in various combinations, these three sizes are sufficient to provide any required thickness for correct tooth contact pattern. Consult the shim chart on Page 4-64 for a list of combinations.

If it is necessary to change pinion shim, the backlash should be rechecked as in Note 48c, Step 2. The final tooth contact pattern should be checked after backlash, pinion preload, and case spread have been set.

14. Install lock tab on adjuster nut. Tighten to 18 foot-pounds.

15. Using a new differential carrier cover gasket, position brake line clamp, gasket, and differential cover on carrier and install 12 screws. Tighten screws to 30 foot-pounds.

p. Completion of Rear Axle Assembly

1. Install axle shafts as described in Note 39d.
2. Install differential carrier nose bumper arm with two screws and lockwashers. Tighten to 50 foot-pounds.
3. Install propeller shaft and remove propeller shaft support wire or belt.
4. Refill rear axle to correct level with rear axle lubricant, Part No. 1050189, or equivalent.

(NOTE: Fluid level is correct when even with lower lip of the filler hole.)

5. Install differential filler plug, tightening to 30 foot-pounds.
6. Install brake drums and bleed brakes.
7. Install both rear wheels. Snug wheel mounting nuts.
8. Lower car.

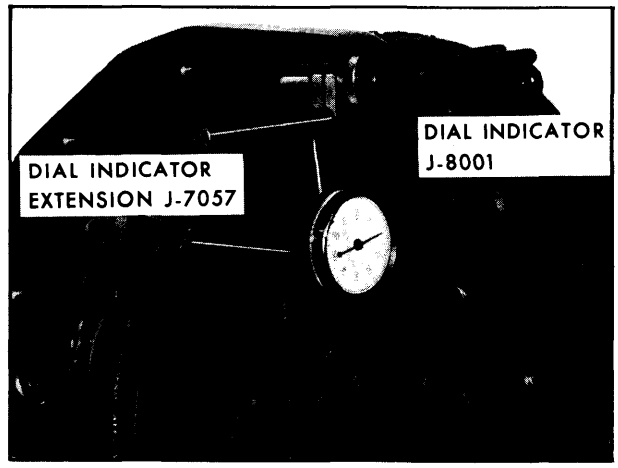


Fig. 4-95 Checking Gear Case Runout

9. Tighten wheel mounting nuts to 130 foot-pounds.

See CAUTION on page 3.

10. Install wheel discs and wheel shields.

49. Correction of Excessive Backlash Variance

1. Remove gear case assembly from carrier housing.
2. Remove ring gear from gear case. Check for any dirt or foreign particle that may have been trapped between ring gear and case. This is the most likely cause of backlash variance. Surface between ring gear and case must be absolutely clean.
3. Replace gear case in housing without ring gear. Use dial indicator to check runout of gear case, Fig. 4-95. If runout exceeds .003", replace gear case.
4. If gear case runout is less than .003" replace ring gear and pinion gear.

(NOTE: If backlash variance is only slightly above specification, .0035" for example, and gear case runout accounts for only part of the total, for instance .002", re-index ring gear 180° from its original position on gear case and test backlash variance. If this is still greater than .003", re-index ring gear another 90° and test again for backlash variance.)

50. Controlled Differential

The Controlled Differential assembly, Fig. 4-96, is serviced only as a unit. Disassembly of the Controlled Differential is intended only for cleaning and inspection of the gear case and its components in the event of a bearing or gear set failure. If any of the parts show signs of excessive scoring, pitting, or wear, the entire unit must be replaced.

(NOTE: When disassembling the Controlled Differential gear case, lay the parts out in the order in which they are removed from the gear case. This is necessary, as the parts are installed as matched sets at time of original assembly.)

a. Disassembly

1. Secure one axle shaft in a vise with splined end

BACK TO INDEX

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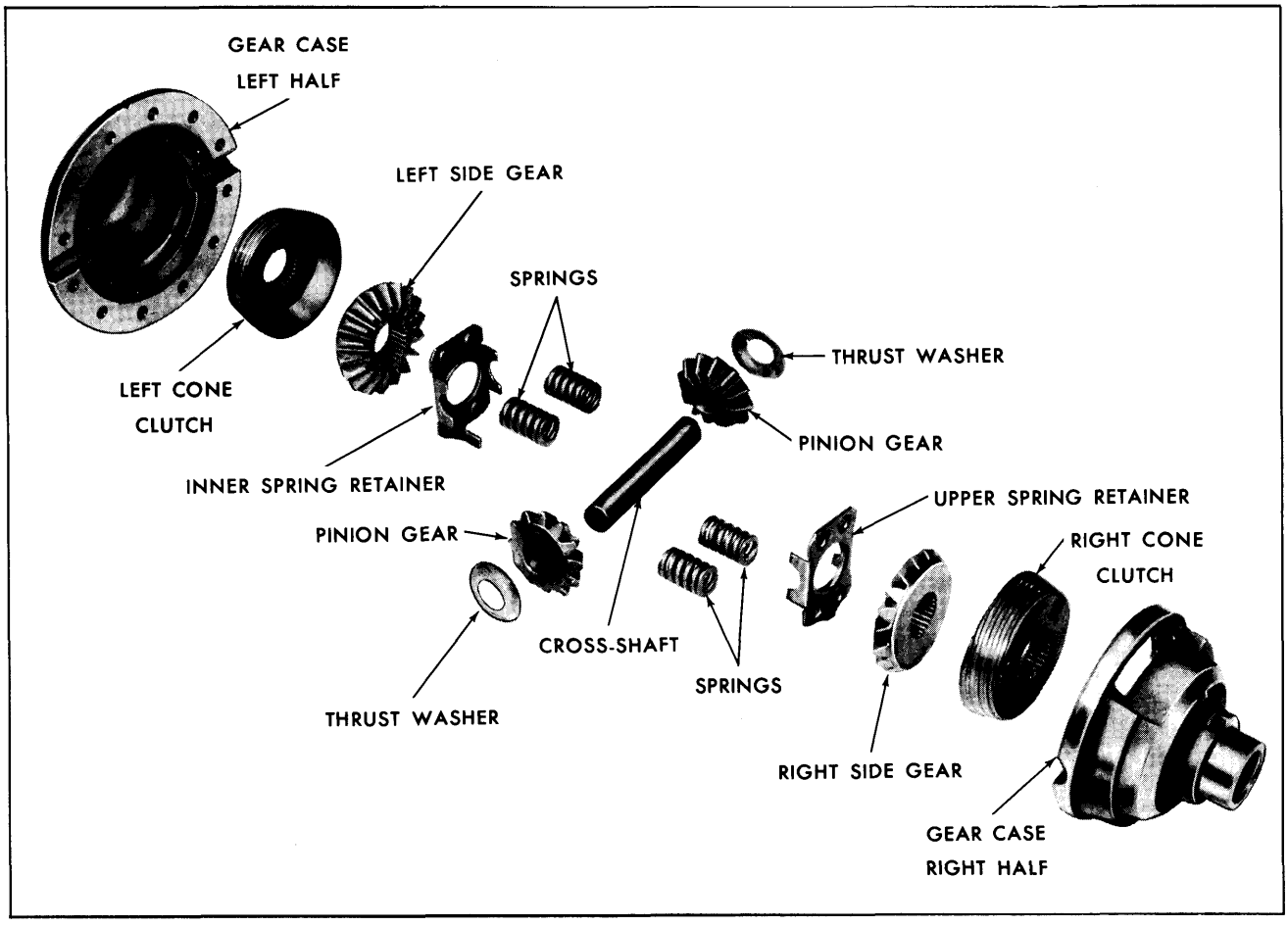


Fig. 4-96 Controlled Differential – Disassembled

of shaft extending three inches above top of vise.

2. Insert gear case on axle shaft.

3. Install Pilot, J-23406, in differential case side bearing, Fig. 4-97.

4. Using Bearing Puller, J-22888-1, remove differential case side bearing, Fig. 4-97.

5. Turn gear case over and fit it into axle shaft splines and repeat Steps 3 and 4 to remove other side bearing.

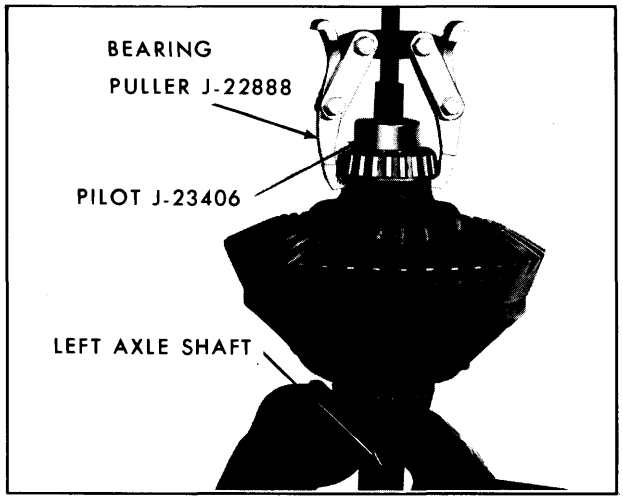


Fig. 4-97 Removing Side Bearings (Controlled)

6. Scribe an alignment mark on differential gear case and ring gear.

7. Loosen 12 ring gear to case bolts.

(NOTE: These bolts have left hand threads.)

8. Remove only three of the 12 bolts and install Guide Pins, J-23316-1.

9. Remove gear case from axle shaft and place on table covered with cardboard, with ring gear facing downward.

10. Remove remaining nine bolts.

11. Tap on guide pins to unseat and remove ring gear.

12. Insert gear case on axle shaft with right half of gear case on splines of axle shaft.

WARNING: THE CONTROLLED DIFFERENTIAL GEAR CASE IS SPRING LOADED. DO NOT REMOVE SCREWS UNTIL CASE HALVES SEPARATE, AS INJURY OR DAMAGE MAY RESULT.

13. Alternately loosen eight screws securing differential gear case halves until case halves separate.

14. After case halves separate, remove all eight screws.

15. Remove left case half.

BACK TO INDEX

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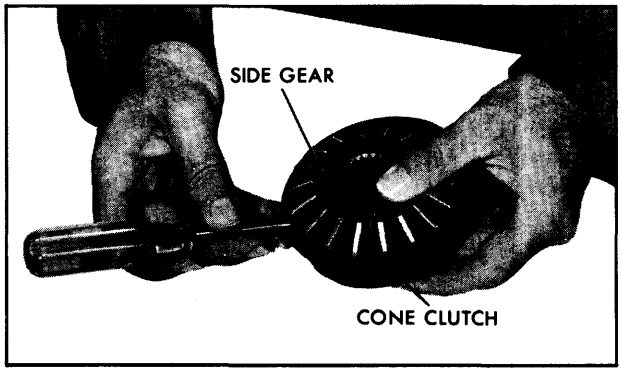


Fig. 4-98 Separating Side Gear and Cone Clutch

CAUTION: Left side gear and cone clutch may stick in left half of gear case. Use care when removing left half of gear case to prevent cone clutch and side gear from falling and becoming damaged.

16. Using a thin bladed screwdriver, remove left side gear from cone clutch, Fig. 4-98.
17. Remove upper spring retainer from unit, Fig. 4-99.
18. Lift cross shaft to unseat shaft from lock pin, and remove cross shaft, pinion gears, and pinion gear thrust washers, Fig. 4-100.
19. Remove differential cross shaft lock pin.
20. Remove four springs.
21. Remove lower spring retainer.
22. Remove remaining cone clutch and side gear from right gear case half.
23. Using a thin bladed screwdriver, remove side gear from cone clutch, Fig. 4-98.

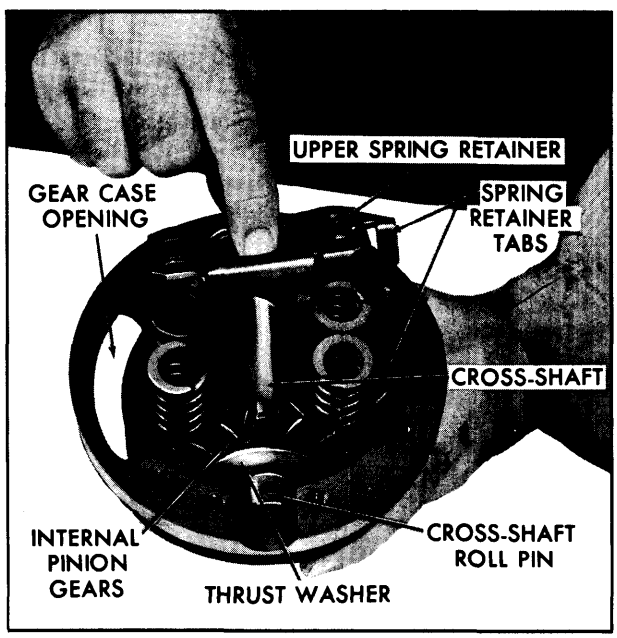


Fig. 4-99 Removing and Installing Upper Spring Retainer

b. Cleaning and Inspection

1. Make certain all parts are absolutely clean and dry.

CAUTION: When cleaning Controlled Differential components, use petroleum base solvents only. DO NOT use solvents containing chlorine or active sulfur, as they will contaminate clutch surfaces and cause chatter. If any parts are excessively scored, nicked, pitted, or worn, the entire unit must be replaced. The components of the Controlled Differential are individually matched and comprise a set.

2. Inspect pinion and side gears, brake cone surface, and cone seat in case. The cone seat in case should be smooth and free of excessive scoring. Slight grooves or scratches, indicating passage of foreign material, are permissible and normal. Check the ends of cone for indications of bottoming in the case. If bottoming is evidenced, replace the complete gear case assembly. The land surface on the heavy spirals of the cone will duplicate case surface conditions.

c. Assembly

(NOTE: All parts must be assembled in their original position.)

1. Lubricate all parts with differential lubricant.
2. Secure right axle shaft in a vise with splined end extending three inches above vise.
3. Place right half of gear case on axle shaft.
4. Install right cone clutch over axle shaft and into right half of gear case.
5. Install right side gear over axle shaft and into right cone clutch.
6. Install inner spring retainer and springs in right half of gear case with the tab on retainer opposite opening in gear case, Fig. 4-99.

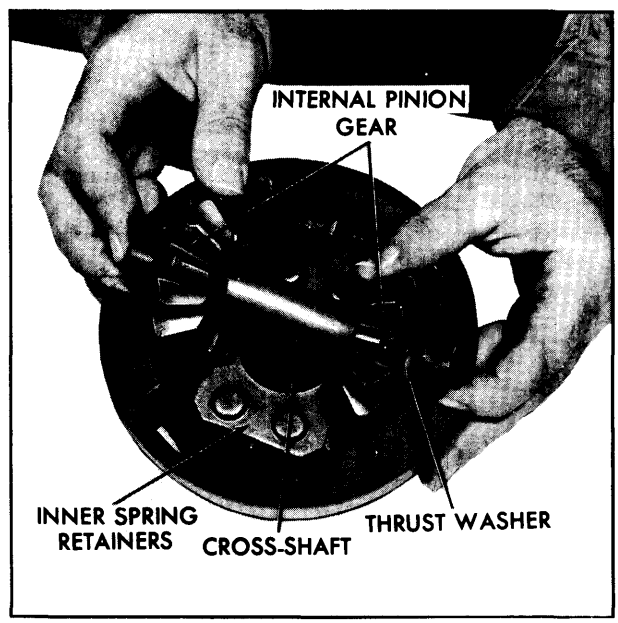


Fig. 4-100 Removing and Installing Pinion Gears, Cross Shaft and Thrust Washers

BACK TO INDEX

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(NOTE: After spring retainer and springs are installed, check to make sure springs are properly seated on spring retainer seats.)

7. Install pinion gears and thrust washers on cross shaft.
8. Install cross shaft lock pin in hole in right half of gear case.
9. Install cross shaft, pinion gears, and thrust washers, in right half of gear case, Fig. 4-100.

(NOTE: Make sure cross shaft is properly seated on lock pin.)

10. Install upper spring retainer with tab on retainer opposite opening in gear case and aligned with tab on other retainer, Fig. 4-99.

(NOTE: After retainer is installed, check to make sure that spring seats on retainer are centered in the springs.)

11. Position left side gear on upper spring retainer.
12. Install left cone clutch on left side gear, making sure splines in cone clutch align with splines in left side gear.
13. Position left half of gear case on right half.
14. Install eight gear case screws finger tight.
15. Install left axle shaft in gear case to align splines in left cone clutch with splines in left side gear.
16. Leaving left axle shaft in place, alternate tightening gear case screws to 30 foot-pounds, Fig. 4-101.
17. Remove left axle shaft from gear case.

(NOTE: It may be necessary to tap on axle shaft with a soft mallet to permit removal of shaft from gear case.)

18. Remove gear case from axle shaft secured in vise.
19 Install Guide Pins, J-23316-1, in ring gear.
20. Using alignment marks made on disassembly, align ring gear case and position ring gear on case.
21. Install nine ring gear to differential gear case bolts finger tight.

(NOTE: These bolts have left hand threads.)

22. Using a soft mallet, tap ring gear down onto gear case.
23. Remove guide pins and install remaining three bolts.

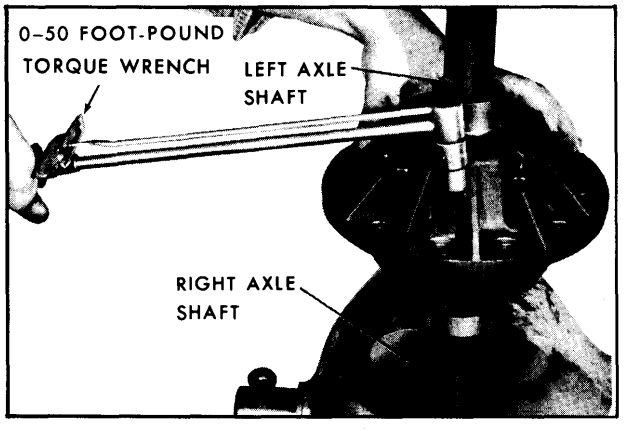


Fig. 4-101 Tightening Gear Case Screws (Controlled)

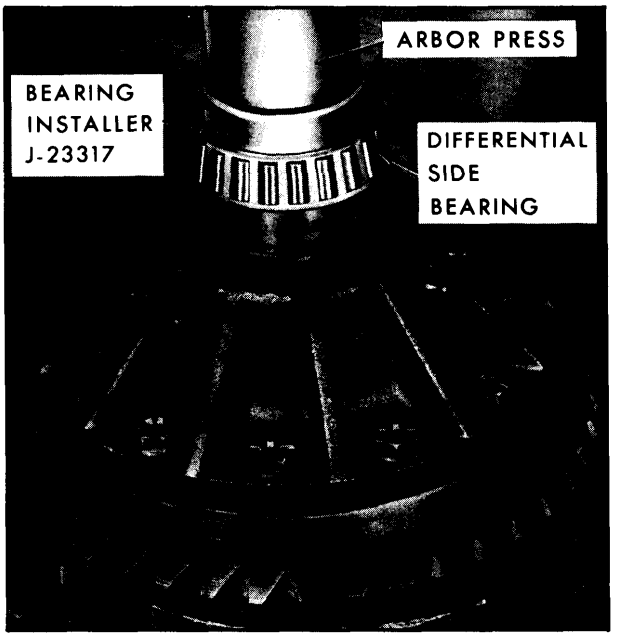


Fig. 4-102 Installing Differential Side Bearings (Controlled)

24. Install gear case on axle shaft with ring gear facing downward.
25. Alternate tightening ring gear bolts to 85 foot-pounds.
26. Remove gear case from axle shaft.
27. Position bearing and Side Bearing Installer, J-23317, and using arbor press, install side bearing on gear case, Fig. 4-102.
28. Repeat Step 27 to install remaining side bearing.

51. Checking Pinion Flange Runout—On Car

1. Position car on hoist so that rear wheels are free to rotate when car is raised.
2. Install wire or fan belt to support propeller shaft, Fig. 4-30, and remove propeller shaft from pinion flange.
3. Using a wire brush, clean pinion flange face and propeller shaft rear flange pilot thoroughly.
4. Remove one pinion retainer screw and install Dial Indicator, J-8001, and Support, J-6126, so that stem touches flange face between mounting bolt holes and pilot diameter, Fig. 4-67. Set dial to zero.
5. Rotate pinion flange by rotating rear wheel one complete revolution and note maximum face runout reading.
6. Install Dial Indicator Extension, J-7057, on dial indicator, and reposition indicator so that stem touches side of pinion flange pilot diameter, Fig. 4-68.
7. Repeat Step 5 to find radial runout. Combined face and radial runout should not exceed .005". Remove dial indicator apparatus and install pinion retainer screw.
8. If runout is satisfactory, re-attach propeller shaft, remove propeller shaft support wire or fan belt, and lower car.
9. If combined runout is not within specification, perform the following procedure in exact sequence:

BACK TO INDEX

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a. Remove two attaching screws and lockwashers that secure differential carrier nose bumper arm and remove nose bumper arm.

b. Place a drain pan under differential to catch lubricant.

c. Remove pinion assembly from differential housing, Note 48d, Steps 1 through 7.

d. Remove and discard pinion retainer O-ring.

e. Partially disassemble pinion assembly as described in Note 48f, Steps 2 through 11.

f. Remove collapse spacer and install a new collapse spacer on pinion shaft.

g. Re-index pinion flange 90° using alignment mark made on disassembly.

h. Reassemble pinion, following Note 48m Step 9, and Steps 14 through 24.

i. Install pinion assembly, Note 48n, and check runout.

j. Install differential housing nose bumper arm with two screws and lockwashers. Tighten screws to 50 foot-pounds.

k. Install propeller shaft and remove propeller shaft support wire or fan belt.

l. Lower car.

SPECIFICATIONS

Pinion Flange Combined Face and Radial Runout	.005"
Cap Spread	.003" – .004"
Pinion Bearing Preload	
Used Bearings	5 inch-pounds higher than reading found on disassembly, but no higher than 15 inch-pounds total.
New Bearings	22–30 Inch-Pounds
Ring Gear to Pinion Backlash	
Vehicle Mileage Less than 3000	.006" – .008"
Vehicle Mileage Greater than 3000	Re-establish Reading Found on Disassembly

SHIM CHART

PINION SHIM COMBINATIONS

Prod. Size	Service Sizes			Prod. Size	Service Sizes		
	.010	.007	.006		.010	.007	.006
.016	1		1	.027	2	1	
.017	1	1		.028	1		3
.018			3	.029	1	1	2
.019		1	2	.030	3		
.020	2			.031	1	3	
.021		3		.032	2		2
.022	1		2	.033	2	1	1
.023	1	1	1	.034	2	2	
.024	1	2		.035	1	1	3
.025		1	3	.036	3		1
.026	2		1				

BACK TO INDEX

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SIDE BEARING SHIMS

Size	Color	No. of Stripes	Size	Color	No. of Stripes
.1015	Yellow	1	.1185	White	3
.1025	Yellow	2	.1195	White	4
.1035	Yellow	3	.1205	White	5
.1045	Yellow	4	.1215	Green	1
.1055	Yellow	5	.1225	Green	2
.1065	Orange	1	.1235	Green	3
.1075	Orange	2	.1245	Green	4
.1085	Orange	3	.1255	Green	5
.1095	Orange	4	.1265	Pink	1
.1105	Orange	5	.1275	Pink	2
.1115	Blue	1	.1285	Pink	3
.1125	Blue	2	.1295	Pink	4
.1135	Blue	3	.1305	Pink	5
.1145	Blue	4	.1315	Black	1
.1155	Blue	5	.1325	Black	2
.1165	White	1	.1335	Black	3
.1175	White	2	.1345	Black	4

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot-Pounds
300-M	Bearing Cap Bolts	7/16–14	50
300-M	Ring Gear-to-Gear Case Bolts	7/16–20	85
280-M	Pinion Retainer-to-Carrier Screws	3/8–16	30
300-M	Gear Case Bolts (Controlled)	5/16–18	30
Special	Carrier Rear Cover Screws	5/16–18	30
275-M	Adjuster Nut Lock Tab Screw (Screw and Washer Assembly).	5/16–18	18
286-M	Pinion Nut	7/8–14	See Pinion Assembly
300-M	Differential Carrier Nose Bumper Arm Screws	7/16–14	50
300-M	Pinion Flange to Universal Joint Flange Attaching Screws	7/16–20	70*
1112	Differential Filler Plug	1/2–14	30

(NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings, and steel classifications.)

**CAUTION: These fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. Each must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.*

BACK TO INDEX

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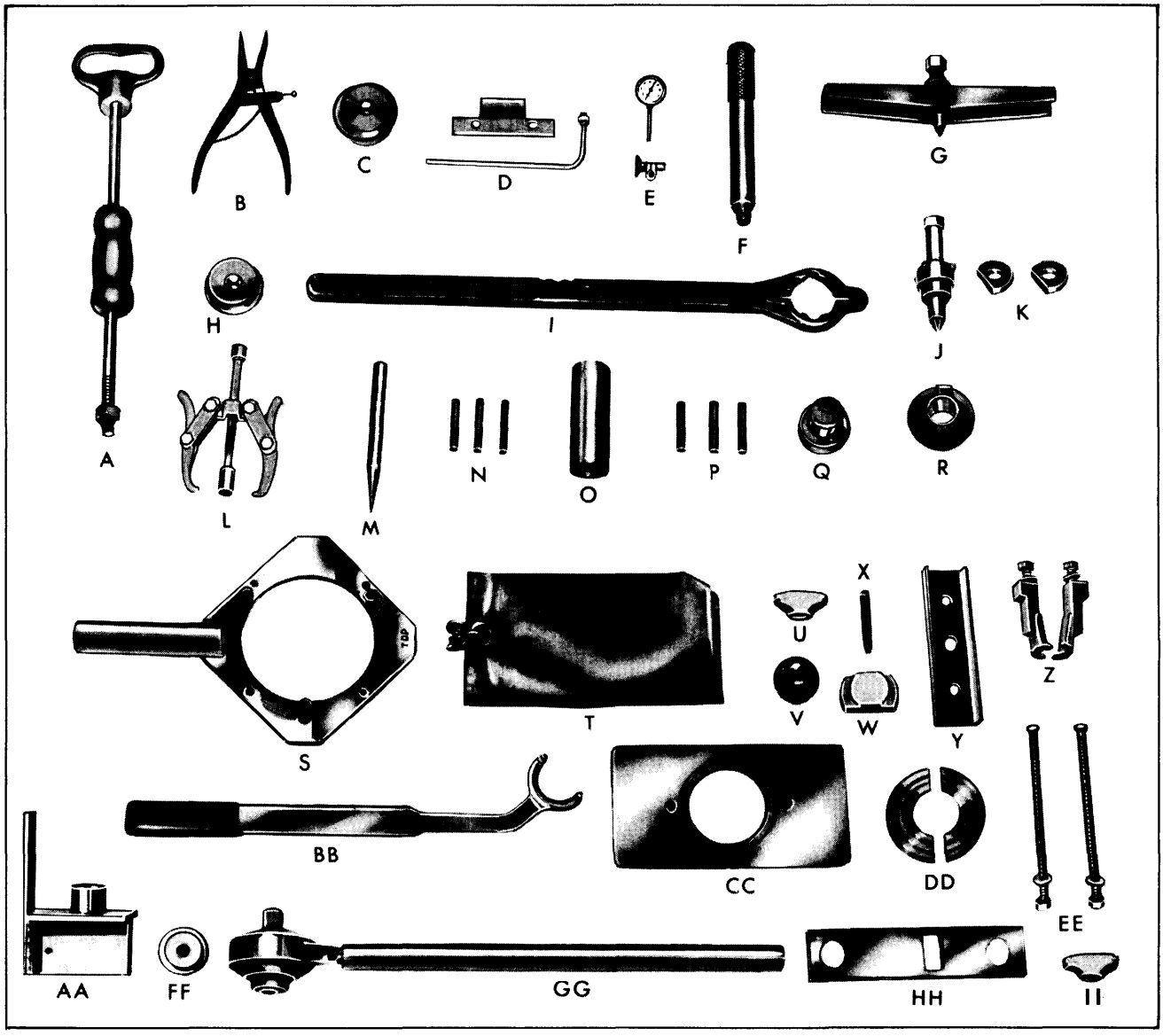


Fig. 4-103 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-2619	Slide Hammer	R	J-23318	Pinion Oil Seal Installer
B	J-4646	Snap Ring Pliers	S	J-23320	Holding Fixture
C	J-6197	Pinion Inner Bearing Cup Installer	T	J-23320-1	Retaining Bag
			U	J-23321	Pinion Inner Bearing Cup Remover
D	J-23409	Dial Indicator Extension and Support	V	J-23322	Straddle Bearing Installer
E	J-8001	Dial Indicator	W	J-23323-5	Straddle Bearing Remover
F	J-8092	Universal Handle	X	J-23323-2	Driver Bolt
G	J-8433-1	Puller Bar	Y	J-23324	Pinion Puller
H	J-8611-1	Pinion Bearing Cup Installer (Outer)	Z	J-23345-1	Bearing Puller Legs
			AA	J-23372	Holding Tool
I	J-8614-1	Pinion Flange Holding Tool	BB	J-23398	Spanner Wrench
J	J-8614-2	Pinion Flange Puller	CC	J-23399-1	Bearing Plate
K	J-21044-5	Spacers	DD	J-23399-2	Bearing Puller
L	J-22888-1	Side Bearing Puller (Controlled)	EE	J-23399-4	Bolts
M	J-23310	Side Gear Aligning Pin	FF	J-23406	Side Bearing Pilot
N	J-23311	Pinion Retainer Guide Pin Set	GG	J-23410	Torque Multiplier
O	J-23314	Pinion Inner Bearing Installer	HH	J-23413	Torque Multiplier Link
P	J-23316-1	Ring Gear Guide Pins	II	J-23671	Pinion Outer Bearing Cup Remover
Q	J-23317	Side Bearing Installer			

BACK TO INDEX

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TABLE OF CONTENTS

Subject	Page No.
THEORY OF OPERATION	5-3
DIAGNOSIS	5-5
SERVICE INFORMATION	5-8
Bleeding and Adjustments	5-8
Bleeding Brakes	5-8
Rear Drum Brake Shoe Adjustment	5-10
Parking Brake Adjustment	5-10
Stoplight Switch Adjustment	5-11
Front Disc Brakes	5-11
Rear Drum Brakes	5-17
Parking Brakes	5-20
Hydraulic Lines	5-21
Brake Combination Valve	5-21
Servicing Hoses and Piping	5-22
Brake Tubing	5-23
Power Brake Units	5-24
Master Cylinder	5-25
Tandem Diaphragm (Power Head)	5-26
Specifications	5-33
TRACK MASTER	5-35
Theory of Operation	5-35
Diagnosis	5-38
Service Information	5-47
THEORY OF OPERATION—ELDORADO	5-49
DIAGNOSIS — ELDORADO	5-50
SERVICE INFORMATION—ELDORADO	5-51
Rear Disc Brakes	5-51
Parking Brake Adjustment	5-57
HYDRO-BOOST	5-59
Theory of Operation	5-59
Diagnosis	5-59
Service Information	5-61
Trouble Shooting and Testing	5-66
Bleeding Procedure	5-67
Specifications	5-68

BACK TO INDEX

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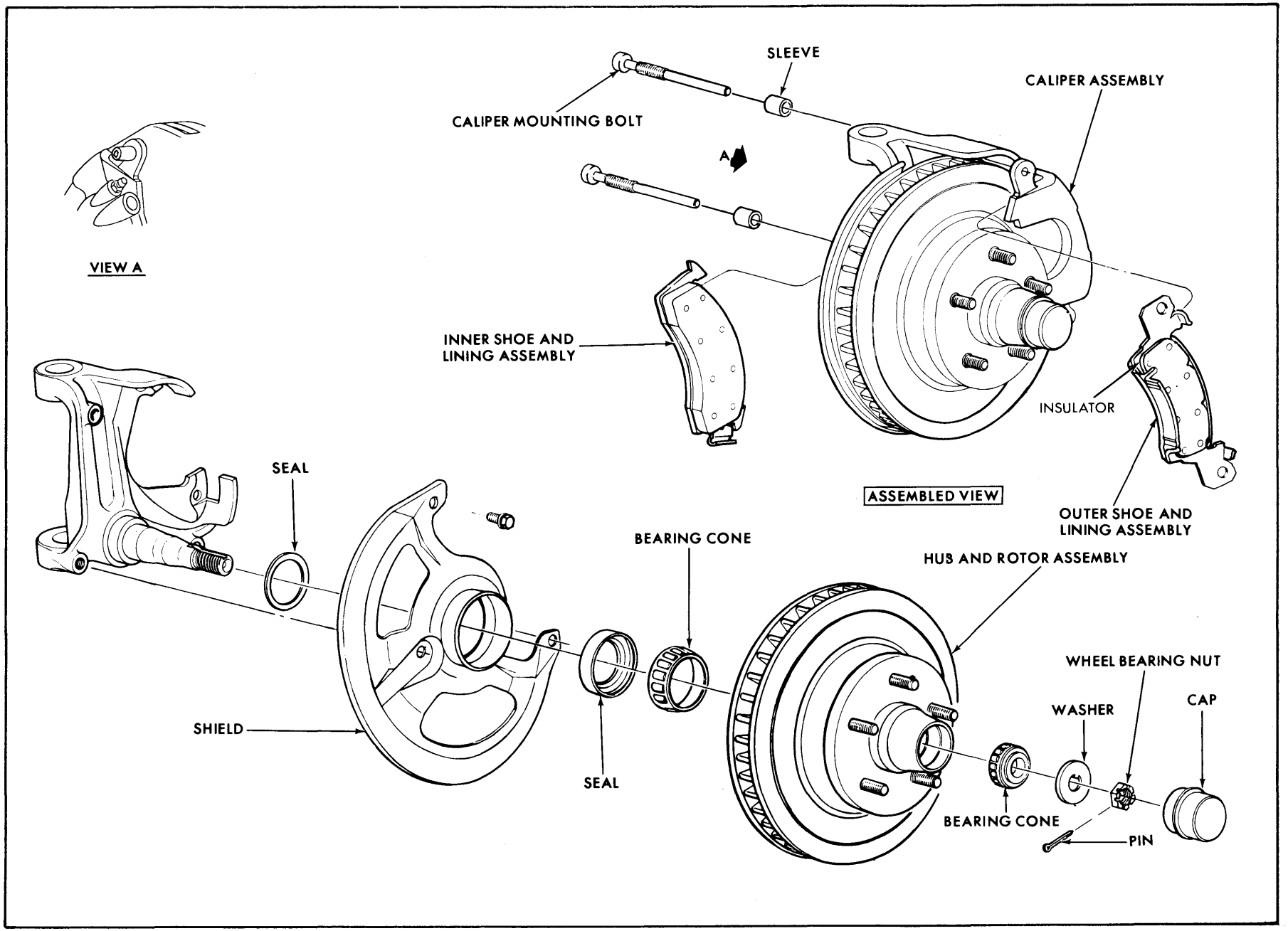


Fig. 5-1 Front Disc Brake

BACK TO INDEX

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THEORY OF OPERATION

(NOTE: For information pertaining specifically to the Eldorado brake system, refer to the latter portion of this section.)

Single Piston sliding caliper Disc Brakes are used at the front wheels while drum brakes are used at the rear wheels on all rear drive cars.

A hydraulically operated power brake booster (Hydro-boost) is used on Eldorados, Limousines and the Commerical Chassis.

Eldorados are equipped with a four wheel disc brake system in addition to the Hydro-boost.

A dual master cylinder with a tandem diaphragm vacuum power assist unit is used on all other series cars.

A combination valve incorporates the metering valve, proportioning valve and pressure differential switch into one part.

The foot actuated parking brake mechanically applies the rear brakes. The parking brake is released automatically by engine vacuum when the engine is running and the transmission selector is placed in any position other than neutral or park.

Single Piston Sliding Caliper Front Disc Brakes (Fig. 5-1 and 5-2)

The major components of the single piston sliding caliper front disc brake mechanism are the hub and rotor assembly, the caliper assembly, the shoe and lining assemblies and the splash shield. The hydraulic system also utilizes a combination valve.

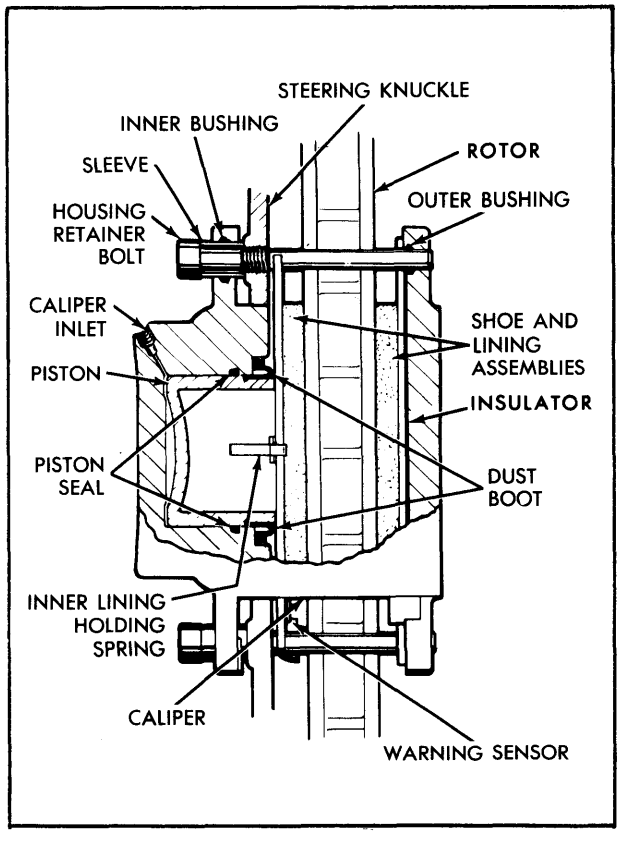


Fig. 5-2 Caliper Cutaway View

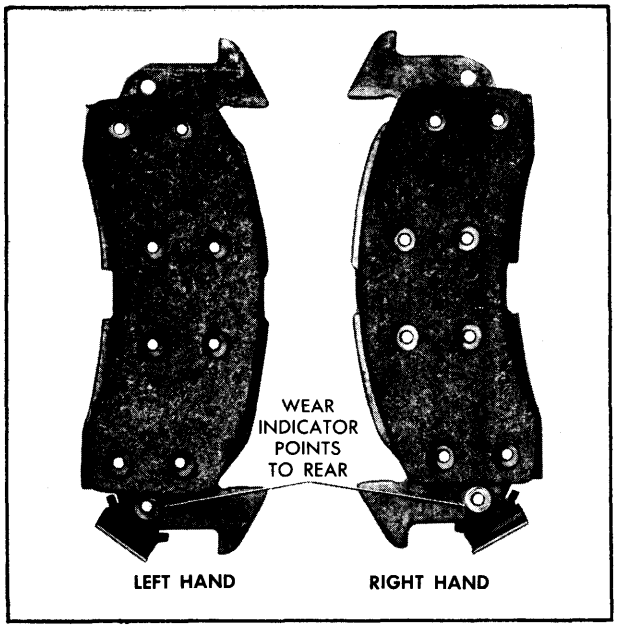


Fig. 5-3 Inboard Disc Brake Shoes

a. Hub and Rotor Assembly

The cast iron hub and rotor assembly is fully ventilated with 35 cooling fins cast integrally between the machined braking surfaces. When the wheel is in motion, the rotation of the rotor fins increases the air circulation for more efficient cooling of the unit.

b. Caliper Assembly (Front)

The caliper provides a means of applying the shoe and lining assemblies to the rotor. It is hydraulically connected to the system by a tube and flexible hose leading from the brake combination valve to each caliper inlet port. It is mounted to the integral steering knuckle by two allen head retainer bolts, two sleeves and four rubber bushings. An inner caliper bushing is installed between each sleeve and groove in the housing, and an outer caliper bushing is installed between each bolt and groove in the housing. Inner and outer shoes and lining assemblies are positioned on the caliper so they straddle the rotor.

c. Shoe Lining Assemblies

The brake linings are attached to the shoes with steel eyelets to form front shoe and lining assemblies.

The inner shoe includes a spring steel wear indicator, Fig. 5-3, which will deliver a squealing or cricket-like warning noise when the linings have reached a point where replacement is necessary. The sound occurs when wheels are turning, but will disappear when the brake pedal is applied firmly.

The outer shoe and lining assemblies have an insulator attached to the shoes. The function of the insulator is to reduce brake squeak.

BACK TO INDEX

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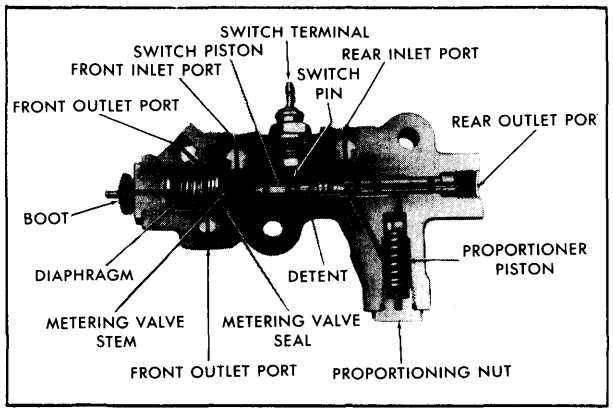


Fig. 5-4 Brake Combination Valve

d. Brake Combination Valve (Fig. 5-4)

The combination valve is located on the frame side rail extension at the left side of the car. The combination valve incorporates three functions as follows:

1. The metering valve (hold-off section) incorporates lines leading to the caliper assemblies.

The purpose of the hold-off valve is to limit pressure to the front disc brakes until the rear drum brakes are activated (rear line pressure must overcome the rear brake shoe return spring tension before the rear brakes actuate).

2. The pressure differential section monitors the front and rear brake systems to measure any difference in pressure from the master cylinder. If a sufficient pressure differential exists between the systems an electrical ground is made energizing the BRAKES tell tale light on the right side of the instrument cluster if the ignition switch is on. The valve and switch are so designed that the switch will latch in the "warning" position once a failure has occurred. The only way the light can be turned off is to repair the failure and apply a pedal force as required to develop up to 450 psi line pressure.

3. The proportioning section of the valve proportions outlet pressure to the rear brakes after a predetermined rear input pressure has been reached. This is done to prevent rear wheel lock-up on a vehicle with light rear wheel loads. The valve is designed to have a "by-pass" feature which assures full system pressure to the rear brakes in the event of a front brake system malfunction.

(NOTE: The brake combination valve on Limousine and Commercial series does not include the proportioning valve section.)

Rear Drum Brakes

The rear drum brake system consists of brake shoes (two per wheel) with riveted composition linings acting

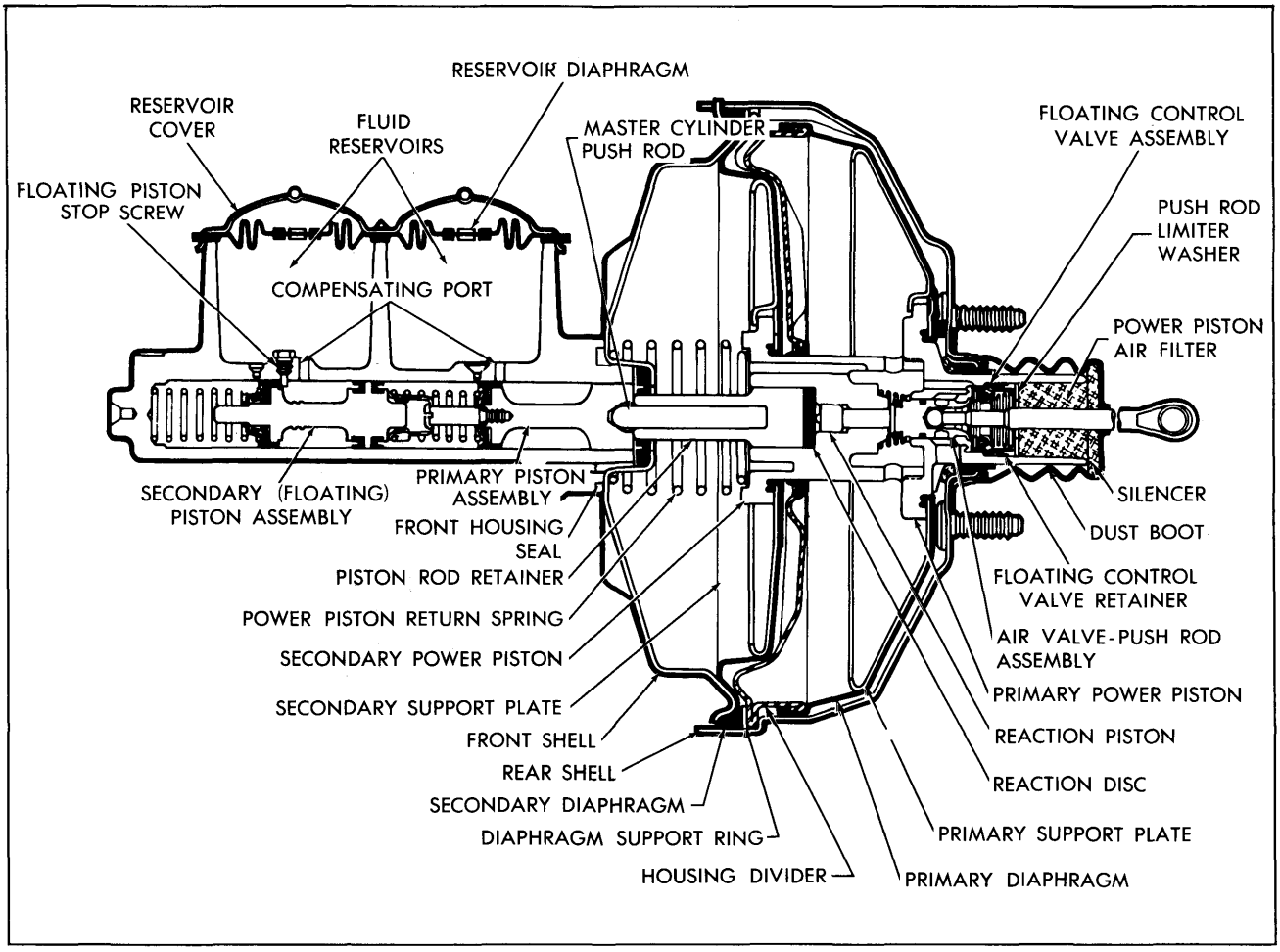


Fig. 5-5 Tandem Diaphragm Vacuum Power Brake Unit

BACK TO INDEX

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on cast iron-steel brake drums. The linings are forced against the drums by hydraulic pressure for normal braking and by a foot lever, through a mechanical linkage to the brake shoes, for the parking brake.

The automatic adjusters can engage when the brakes are applied while the car is moving rearward with light pedal application, or after an uphill stop. Adjustment actually occurs only when there is excessive clearance between the lining and the drum.

Parking Brake

The parking brake pedal assembly is mounted on the cowl to the left of the service brake pedal. The parking brake will release automatically when the transmission selector lever is moved into any drive position with the engine running. It will not release automatically, however, with the engine running and the selector lever in Neutral or Park, or in any position with the engine off. A manual release lever, located on the inboard side of the parking brake assembly, may be used if the automatic release is inoperative or if manual release is desired at any time. When the parking brake is applied, an electric ground is made energizing the brake tell tale warning light if the ignition switch is on.

Tandem Diaphragm Vacuum Power Brake Unit

The vacuum power brake unit consists of a tandem diaphragm vacuum power section and a dual hydraulic master cylinder.

The master cylinder is designed so that the front and rear service brakes have separate hydraulic systems. The front section of the master cylinder provides fluid for the rear brakes, while the rear section provides fluid for the front brakes. Should a leak occur in the front hydraulic system, the rear brake system will still function. Likewise, if the rear hydraulic system should develop a leak, then the front system would still function. Increased brake pedal travel and an instrument panel brake light warns the driver that such a condition may have occurred.

The tandem diaphragm vacuum power unit has a vacuum power chamber that consists of a front and rear shell, a housing divider, front and rear diaphragm and plate assemblies, a hydraulic push rod, and a diaphragm return spring, Fig. 5-5.

The unit operates so that the two diaphragm and plate assemblies utilize the differential pressure created by engine intake manifold vacuum and atmospheric pressure to assist the hydraulic push rod.

Brake Stoplight Switch

The brake stoplight switch is mounted on a flange on the brake pedal support bracket below the instrument panel. When the brake pedal is depressed, the spring loaded switch plunger follows the brake pedal arm downward until the switch is in the "on" position. When the brakes are released, the arm returns the switch plunger to the "off" position.

Brake Fluid

It is recommended that Part Number 546 4831 brake fluid or equivalent fluids meeting DOT-3 specifications be used in Cadillac brake systems.

Brake fluid should always be stored in closed containers, as it will absorb moisture from the atmosphere. Moisture contamination of brake fluid causes the boiling point of the fluid to be lowered.

DIAGNOSIS

1. Testing Brake System

a. Vacuum Power Section

1. Attach one end of spare windshield washer pump inlet hose to the port nearest the shut-off valve of Leak Testing Tool, J-23108, Fig. 5-6.
2. Disconnect power brake hose to vacuum pipe from carburetor and attach the other end of the windshield washer pump inlet hose to this fitting. A small amount of silicone lubricant will facilitate installation.
3. Connect the power brake hose to other port of the tester and secure with hose clamp, Fig. 5-6.
4. Run engine at idle for approximately 1/2 minute.
5. Turn off shut-off valve on tee.
6. Note vacuum gage reading.
7. Apply brakes with estimated 20-30 pounds force (the effort required for a moderate stop). While holding pedal force as constant as possible, note vacuum gage reading immediately after applying brake and one-half minute later.

(NOTE: If pedal pressure is relaxed, vacuum reading will be incorrect.)

a. Immediate reading should not be more than six inches of mercury less than initial reading taken after closing shutoff valve. Any release of the brake pedal will increase the reading. Subsequent drop in vacuum reading while holding brakes applied should not exceed two

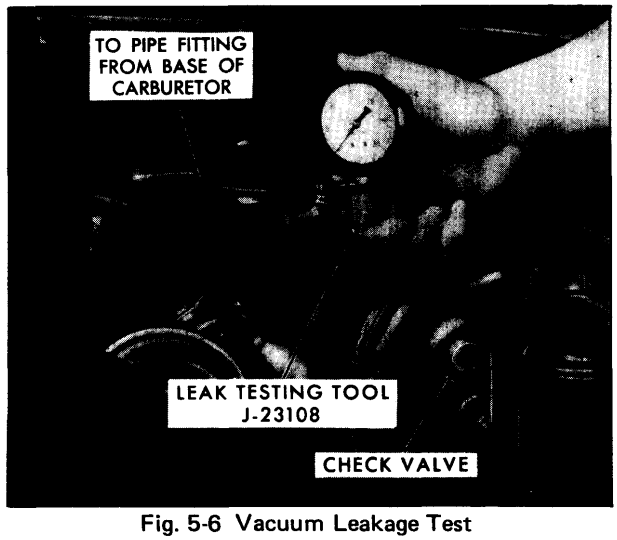


Fig. 5-6 Vacuum Leakage Test

BACK TO INDEX

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inches of mercury per 1/2 minute. If vacuum leak exceeds specification, power unit must be serviced.

b. Master Cylinder Section

(NOTE: These tests will not determine all master cylinder malfunctions. Use the diagnosis chart to help isolate the problem if it is not resolved by these tests.)

1. Check for a cracked master cylinder casting or brake fluid around master cylinder.

Leaks are indicated only if there is at least a drop of fluid. A damp condition is not abnormal.

2. Remove fluid reservoir cover, rapidly depress brake pedal. A geyser should be seen at front reservoir as the brake pedal is rapidly depressed.

a. If system fails this test, check for a binding pedal linkage and incorrect push rod adjustment. If both of these are satisfactory, disassemble the master cylinder and check for swollen or elongated primary piston seal(s). Also see Note 3.

c. Brake Combination Valve

(NOTE: The metering section of the valve is not used on the Eldorado.)

1. Metering Valve—Proper operation of the metering valve can be checked by installing pressure brake bleeder using adapter J-22489-1 and cable J-22489-12.

a. With pressure bleeder energized, open bleeder screw on either caliper. No fluid should come out.

2. Distributor Switch—For operational check.

a. Light should be energized during engine cranking.

b. With engine running, apply moderate pedal force, (approximately 20-30 lbs.). When an assistant opens any bleeder screw, light should go ON indicating an open or problem condition.

c. Close bleeder screw before releasing brake.

d. Upon reapplying pedal force, light should go out.

e. Check master cylinder and bring fluid up to proper level, Note 6b.

3. Proportioner Operation (Except 75 and Commercial)

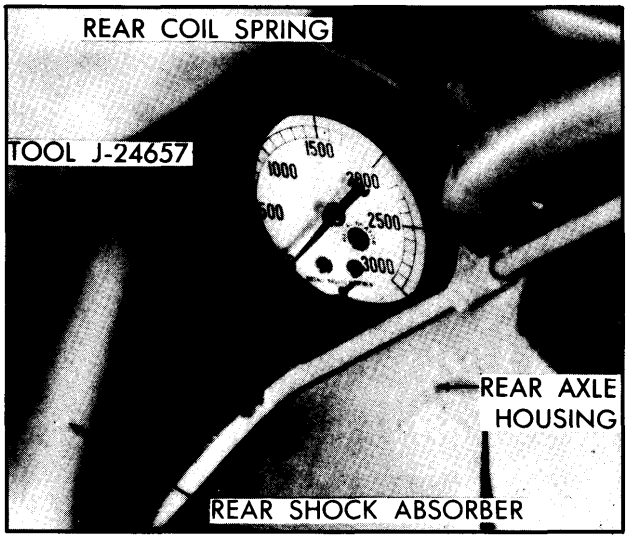


Fig. 5-7 Brake Combination Valve Pressure Gage



Fig. 5-8 Checking Brake Pedal Height

(NOTE: The Eldorado rear caliper has a larger bleeder screw than the bleeder screw used on drum brake wheel cylinders. To adapt the present pressure gage to the rear caliper, use a weatherhead 46 x 3 female coupling or equivalent, and a weatherhead 90° elbow 3400 x 4 x 2 or equivalent. Always use a new copper brake hose washer between the coupling and caliper for each test.)

a. Raise car.

b. Remove one of the rear brake bleeder screws and install Pressure Gage Tool J-24657, Fig. 5-7.

c. With engine running at idle and brake pedal applied with 100 lbs. force (approximately the force on each foot when standing) pressure reading should be less than 1,000 psi.

If any of the above specifications are not met, brake combination valve should be replaced.

(NOTE: When removing adapter be careful not to drop copper washer into brake mechanism as this may require disassembly of brake.)

d. Brake Leaks

1. With engine running at idle and transmission in Neutral, depress brake pedal and hold foot pressure on pedal. If pedal gradually falls away under foot pressure, hydraulic system is leaking.

(NOTE: Hydraulic system may be leaking internally as well as externally. See part b, Steps 1 and 2. Also system may appear to pass this test but still have slight leakage.)

e. Excessive Pedal Travel

1. On cars equipped with Tilt and Telescope steering column, place wheel in third position from top.

2. Hook end of tape over top edge of brake pedal pad, at approximately the center of the pad.

3. Unreel tape to rim of steering wheel, Fig. 5-8.

4. Place thumbnail at edge of wheel and take a reading of the extended length.

5. While holding tape, and with engine idling, press pedal with estimated 20-30 pounds force (the effort required for a moderate stop), and note reading on tape measure. The difference between the two readings is the amount of pedal travel.

Pedal travel should not exceed 2-1/16 inch.

BACK TO INDEX

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6. If pedal travel is greater than specification, on rear drum brake cars, first drive the car backward and forward to see if the brake pedal height will return to normal. In rare cases, excessive pedal travel develops if the car is not driven in reverse because the self-adjusting mechanism will actuate only in reverse when the brakes are applied.

Most low pedal problems are caused by air in lines, necessitating bleeding of the system. It may be necessary to bleed the system several times at each fitting. See Note 6.

If pedal travel exceeds specification, there may still be some air in the system.

Other less frequent causes of excessive pedal travel are rear brake shoe adjusters not functioning, shoes require relining, front or rear hydraulic system has lost its fluid, and tapered linings.

f. Road Testing Brakes

Brakes should be tested on dry, clean, smooth and reasonably level roadway which is not crowned. Road test brakes by making brake applications with both light and heavy pedal forces at various speeds to determine if car stops evenly and effectively.

Also drive car to see if it leads to one side or the other without brake application. If it does, check tire pressure, front end alignment and front suspension attachments for looseness. See diagnosis chart for other causes.

2. Testing Brake Tell-Tale Light Operation

1. Make sure wire is connected to brake combination valve.

2. Start engine, while ignition switch is in start position, brake tell-tale light should glow and go off when ignition switch returns to ignition position.

3. If system performs as described in step 2, and pedal height is satisfactory (part d of Note 1), the system is all right.

4. If light fails to glow in start position, perform electrical tests outlined in Section 12, Note 27d.

5. If light does not go out with ignition switch in ignition position, disconnect wire from assembly. If light still does not go out, proceed as follows:

a. If car is equipped with Track Master, see Page 5-68.

b. If car is not equipped with Track Master, see Section 12, Note 27e.

If light goes out, this indicates that the terminal is shorted or there is a leak in the brake system. Check pedal height (part d of Note 1). If brake light glows and pedal height is low, check for all conditions listed in diagnosis chart on Page 5-7. If it is determined the terminal is shorted, replace the assembly.

(NOTE: The design of the brake combination valve is such that once a brake leak is sensed by the unit, a ground is made within the switch that will not be broken until the leak is corrected. Refer to Note 1-c, Step 2.)

3. Substandard or Contaminated Brake Fluid

Improper brake fluid, mineral oil, or water in the fluid may cause the brake fluid to boil or the rubber components in the hydraulic system to deteriorate.

When checking the fluid reservoir level, the level in the rear reservoir may be as low as one inch from the top if the front linings are worn. This is not abnormal.

To check for deterioration of rubber parts, perform step 2 of Note 1b. If primary piston cups are swollen, then rubber parts have deteriorated. This deterioration may also be evidenced by swollen wheel cylinder piston cups on the drum brake wheels.

If deterioration of rubber is evident, disassemble all hydraulic parts and wash with alcohol. Dry these parts with compressed air before assembly to keep alcohol out of system. Replace all rubber parts in system including hoses. Also when working on the brake mechanisms, check for fluid on linings. If fluid is found, replace linings.

If master cylinder piston seals are all right, check for a leakage or excessive heat conditions. If condition is not found and still in doubt, drain fluid, flush with brake fluid, refill and bleed system, Note 6.

4. Brake Hose Assembly

Each brake hose assembly should be inspected for obvious damage. An assembly should be replaced if a fitting has separated from the hose or if the hose is ruptured, damaged, worn, or blistered.

In the event of damage, the position of the assembly should be observed to determine if the installation was made properly. Check front brake hose by turning the wheel fully in both directions to determine if interference was the cause. Any interference could be the result of a wrong part or improper installation.

If the hose assembly is wet, the area should be dried. The brake system should be actuated and the assembly observed for leakage or presence of fluid. If fluid appears at the connection between the end fitting and the wheel cylinder or frame connection, the assembly should be removed and the hose fitting and the connection inspected for dirt or other foreign material. After cleaning by wiping or use of air hose, the part may be re-installed and the above check repeated. If fluid reappears, replace the part.

If fluid appears on the hose itself or at the junction of the hose and end fitting, the assembly should be replaced.

5. Parking Brake Preliminary Checks

It is not always necessary to replace the parking brake assembly or vacuum diaphragm assembly in cases of an inoperative parking brake automatic release. The following checks should be performed as part of your diagnosis to determine the cause and correction of parking brake trouble and to eliminate unnecessary replacement of parking brake components.

1. Check vacuum cylinder piston travel by running engine and moving transmission selector lever from Drive to Neutral. The manual release lever should move up and down as vacuum is applied and released. If no movement is observed, check vacuum system per steps 2 and 3. If movement is slow, (more than one or two seconds to complete the full stroke) diaphragm is leaking or hoses

BACK TO INDEX
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are partially pinched or kinked. Vacuum diaphragm may be replaced as outlined in Note 21.

2. Check for damaged or kinked vacuum hoses and for loose hose connections at parking brake vacuum cylinder, vacuum release valve at back-up light switch, and at engine manifold connection.

3. Check operation of vacuum release valve. Correct as necessary and recheck parking brake operation.

4. Check brake release with vacuum applied. If vacuum cylinder piston completes full stroke but does not release brake, a malfunction of the pedal assembly is indicated. Replace complete parking brake assembly as described in Note 20.

5. Check operation of parking brake with engine off. Parking brake should remain engaged regardless of transmission selector lever position. If not, replace parking brake assembly.

SERVICE INFORMATION

(NOTE: For service information pertaining to the Eldorado, refer to the latter portion of this section.)

BLEEDING AND ADJUSTMENTS

The following caution applies to one or more steps in the assembly procedure of components in this portion of the manual as indicated at appropriate locations by the terminology *"See CAUTION on Page 5-8 prior to Note 6."*

CAUTION: This fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

6. Bleeding Brakes

Bleeding brakes may be made considerably easier through use of one of the pressure brake bleeder tools available. This equipment consists of a tank partially filled with brake fluid and a rubber hose that connects to the hydraulic cylinder reservoir Brake Bleeder Adapter, J-22489-1. Air pressure is applied to the tank to force fluid into the brake system.

Pressure bleeding equipment must be of the diaphragm type. That is, kit must have a rubber diaphragm between the air supply and the brake fluid to prevent air, moisture, oil and other contaminates from entering the hydraulic system.

The Brake Bleeder Adapter, J-22489-1, seals the brake system from atmosphere during the bleeding operation and enables the brakes to be bled with only one hook-up.

a. Pressure Bleeder Method

1. Remove master cylinder reservoir cover and seal assembly and fill both reservoirs with fluid.

2. Install Bleeder Adapter, J-22489-1 and cables J-22489-12, on master cylinder and connect bleeder hose to Bleeder Adapter Cover.

3. Install Tool J-23770 so the metering plunger on the front of the brake combination valve is fully depressed on all cars except Eldorados.

4. Build up pressure in bleeder to 30 psi or maximum recommended by manufacturer.

5. Back off each master cylinder outlet pipe nut one turn catching fluid displaced from outlets in a cloth or can. Retighten pipe nuts. Discard this fluid.

6. Raise car being careful not to damage pressure bleeder equipment.

7. Perform Steps 8 through 11 in the following sequence as required.

a. Track master modulator if car is so equipped.
b. Right rear brake.
c. Left rear brake.
d. Right front brake.
e. Left front brake.

8. Install a box-end wrench on bleeder screw and attach drain hose. Hose discharge end must be submerged in clean brake fluid. Use a clean bottle partially filled with brake fluid.

9. Back off fitting three-quarters turn and bleed brake until there are no more bubbles, then close bleeder screw.

10. Be sure bleeder screw is sealed.

11. Go to the next bleed position in Step 7 and repeat Steps 8, 9, 10 until all positions listed in Step 7 are completed.

(NOTE: Induced pulsation while the bleeder valves are open tends to purge the system and reduce the time necessary to complete the job. This pulsation can be created by pumping the pedal. (1/2" max. travel.)

12. Lower car.

13. Remove Combination Valve Bleeder Retainer, J-23770.

14. Remove pressure bleeding equipment and check reservoir level. Level should be 1/8 inch to 3/8 inch from top.

15. Install master cylinder cover and seal assembly.

16. After bleeding brakes, check pedal travel as described in Note 1, Part e. Rebleed brakes if necessary.

17. Before driving car, be sure a firm pedal is obtained.

b. Manual Bleed Method

If a pressure bleeder is not available the following procedure may be used.

BACK TO INDEX

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BRAKE DIAGNOSIS CHART – EXCEPT ELDORADO

NOTE: Operation of Tell-Tale Brake Light may be checked as outlined in Note 28.

Symptom / CAUSE	Excessive Brake Pedal Travel	Brake Pedal Travel Gradually Increases	Excessive Brake Pedal Effort	Excessive Braking Action	Brakes Slow to Respond	Brakes Slow to Release	Brakes Drag	Uneven Braking Action (Side to Side)	Uneven Braking Action (Front to Rear)	Scraping Noise from Brakes	Brakes Squeak During Application	Brakes Squeak During Stop	Brakes Chatter (Roughness)	Brakes Groan at End of Stop	Brakes Tell-Tale Glows
Leaking Brake Line or Connection	X	XX	X						X						XX
Leaking Wheel Cylinder or Piston Seal	X	XX	X	X				X							X
Leaking Master Cylinder	X	XX	X												X
Air in Brake System	XX		X						X						XX
Contaminated or Improper Brake Fluid	X				X	X	X								X
Leaking Vacuum System			XX		X										
Restricted Air Passage in Power Head		X	X		XX	X									
Damaged Power Head		X	X	X	X	XX									
Worn Out Brake Lining			X	X				X	X	X	X	X		X	
Uneven Brake Lining Wear - Replace	X			X				X	X	X	X	XX		X	X
Glazed Brake Lining - Sand			XX		X			X	X		X	X			
Incorrect Lining Material - Replace			X	X				X	X			X		X	
Contaminated Brake Lining - Replace				XX				XX	XX	X	X	X		X	
Linings Damaged by Abusive Use - Replace			X	XX				X	X	X	X	X		X	
Excessive Brake Lining Dust - Remove with Air			X	XX				XX	XX		X	XX		X	
Heat Spotted or Scored Brake Drums or Rotors				X				X	X		X	X	XX	X	
Out-of-Round or Vibrating Brake Drums												X	XX		
Out-of-Parallel Brake Rotors	X												XX		
Excessive Rotor Run-Out	X												X		
Faulty Automatic Adjusters	X						X	X	X						X
Incorrect Wheel Cylinder Sizes			X	X				X	X						
Weak or Incorrect Brake Shoe Retention Springs				X	X	XX	X	X	XX	X	XX				
Brake Assembly Attachments - Missing or Loose	X						X	X	X	X		X	X	X	
Insufficient Brake Shoe Guide Lubricant							X	X	X	XX	XX				
Restricted Brake Fluid Passage or Sticking Wheel Cylinder Piston		X	X		X	X	X	X	X						X
Improperly adjusted Stoplight Switch or Cruise Control Vacuum Dump							X								
Faulty Metering Valve	X		X	X	X	X	X		X						X
Faulty Proportioning Valve			X	X	X	X	X		X						
Brake Pedal Linkage Interference or Binding			X		X	XX	XX								
Improperly Adjusted Parking Brake							X								
Improperly Adjusted Master Cylinder Push Rod	X					X	XX								X
Incorrect Front End Alignment								XX							
Incorrect Tire Pressure								X	X						
Incorrect Wheel Bearing Adjustment	X									X			X		
Loose Front Suspension Attachments							X	X		XX			X	X	
Out-of-Balance Wheel Assemblies													XX		
Incorrect Body Mount Torque													X		
Need to Slightly Increase or Decrease Pedal Effort														XX	
Operator Riding Brake Pedal			X				X		X					X	
Sticking Caliper or Wheel Cylinder Pistons							XX								

XX – Indicates more probable cause(s)
X – Indicates other causes

BACK TO INDEX

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1. Fill both master cylinder reservoirs with brake fluid and install Tool J-23770 on brake combination valve on all cars except Eldorados.

(NOTE: Keep reservoirs at least partially filled at all times during bleeding operation.)

2. Back off each master cylinder outlet pipe nut one turn and completely depress brake pedal, catching fluid displaced from outlets in a cloth or can. Retighten pipe nuts before releasing pressure on brake pedal. Discard this fluid. Refill reservoirs.

3. Raise car.

4. Perform Steps 5 through 11 in the following sequence as required.

a. Track master modulator if car is so equipped.
b. Right rear brake.
c. Left rear brake.
d. Right front brake.
e. Left front brake.

5. Install a box-end wrench on bleeder screw and attach drain hose. Hose discharge end must be submerged in clean brake fluid. Use a clean bottle partially filled with brake fluid.

6. Open bleeder screw.

7. Fully depress brake pedal and hold.

8. Close bleeder screw.

9. Release brake pedal.

10. Repeat Steps 5 through 9 until brake fluid, containing no air bubbles, emerges from drain hose. Check and refill the master cylinder reservoir as required to prevent air from being drawn in through the master cylinder.

11. Go to the next bleed position in Step 4 and repeat Steps 5 thru 9 until all positions listed in Step 7 are completed.

12. Lower car.

13. Remove Tool J-23770 from the brake combination valve.

14. Check reservoir level. Level should be 1/8 inch to 3/8 inches from top.

15. Install master cylinder cover and seal assembly.

16. After bleeding brakes, check pedal travel as described in Note 1, Part e.

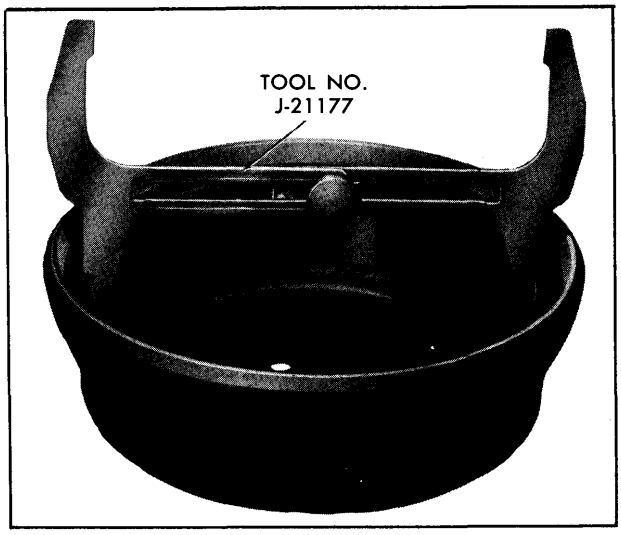


Fig. 5-9 Inside Drum Measurement

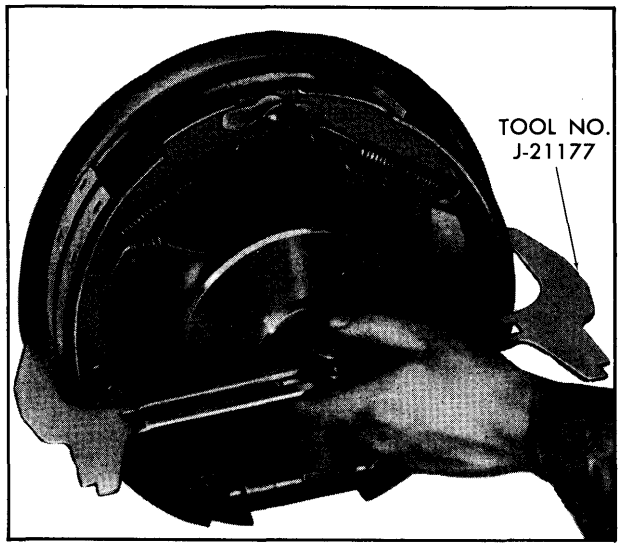


Fig. 5-10 Adjusting Brake Shoes

17. Before driving car, be sure a firm pedal is obtained.

7. Rear Drum Brake Shoe Adjustment

Although the hydraulic service brakes are self-adjusting, a preliminary star wheel adjustment is necessary after the rear brake shoes have been relined or replaced, or when the length of the star wheel adjuster has been changed during some other service operation. Final adjustment is made automatically by adjusters that function when the car is moving backward. No mechanical adjustment is required when replacing front disc brake shoe and lining assemblies.

1. Raise car and remove rear wheels and drums if not already removed.

2. Check to make certain that parking brake cable and linkage, including levers on rear secondary shoes, are free.

3. Measure brake drum I.D. using inside caliper portion of tool J-21177, Fig. 5-9.

4. Adjust brake shoes to dimension obtained on outside caliper portion of tool J-21177, Fig. 5-10.

5. Check brake fluid level in both master cylinder reservoirs. Fluid level should be approximately 1/8 to 3/8 inches below top of reservoir. Add fluid if necessary.

6. Adjust parking brake as described in Note 8.

7. Install drums and wheels. Tighten wheel mounting nuts to 100 foot-pounds. Lower car.

8. Drive car alternately forward and backward, applying brakes moderately in each direction until pedal travel does not exceed specifications listed in Note 1, part d.

CAUTION: When rear brakes are serviced, the parking brake linkage cable at equalizer must always be readjusted to prevent possible burn out of rear brakes.

8. Parking Brake Adjustment — Drum Brakes

"Need for parking brake adjustment is indicated if the hydraulic system operates with good reserve, but

BACK TO INDEX

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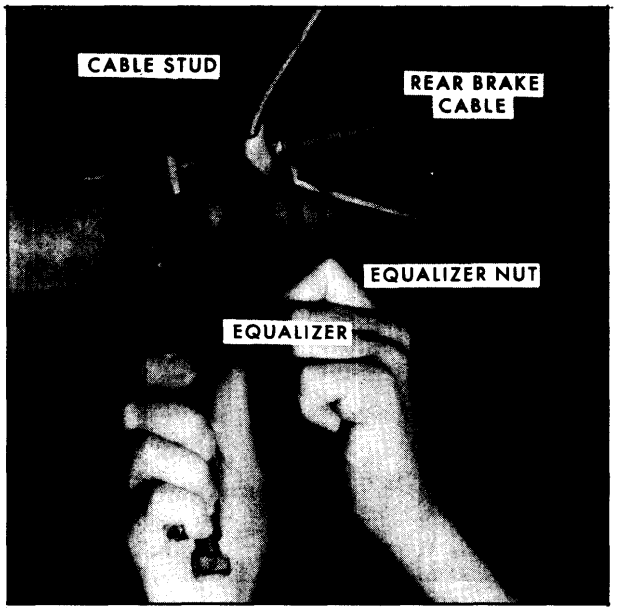


Fig. 5-11 Parking Brake Cable Adjustment

parking brake pedal travel is less than 2 inches or more than 6" inches at 125 pound pedal force (heavy foot pressure)."

(NOTE: Make sure that rear drum brakes are properly adjusted before adjusting parking brake.)

1. Lubricate parking brake cables at equalizer hooks and under body rub points, and check for free movement of all cables.
2. Depress parking brake pedal approximately 1.5 inch from fully released position, measuring with a ruler.
3. Raise rear wheels off floor.
4. Hold brake cable stud from turning, and tighten equalizer nut, Fig. 5-11, until light drag is felt on either wheel (going forward). After each turn of equalizer nut, check to see if either wheel begins to drag.
5. Release parking brake. No brake shoe drag should be felt at either rear wheel. Operate several times to check adjustment.

(NOTE: After adjustment is performed, parking brake pedal should travel 4 inches to 5 inches with approximately 125 pounds force on pedal.)

6. Lower rear wheels.

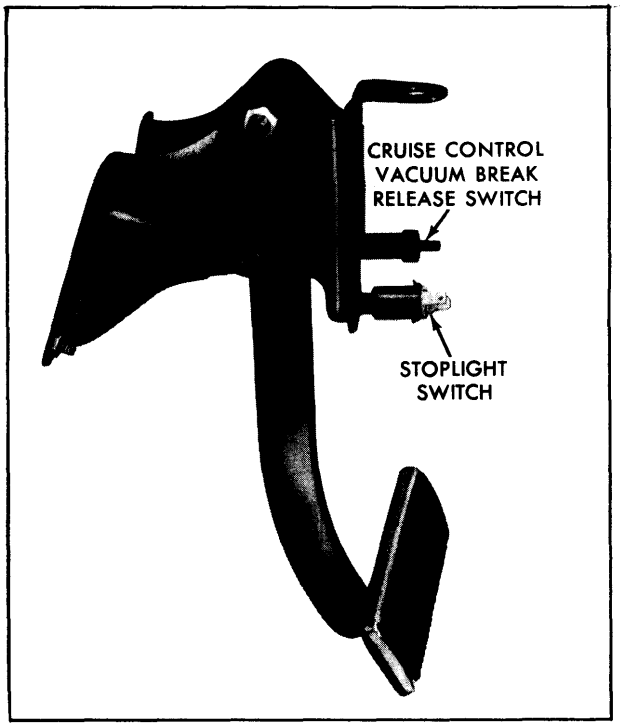


Fig. 5-12 Stoplight Switch Location

9. Stoplight Switch Adjustment

The brake stoplight switch and Cruise Control switch are adjusted in an identical manner. Push the switch well into the retaining clip. Pulling the brake pedal up just enough to reach the normal released position will automatically adjust the switch, Fig. 5-12.

Rotate each switch 1/2 turn counterclockwise to be sure that Stoplight and Cruise Control vacuum switches do not hold brake pedal on after adjustment. There should be free play between brake pedal and switch bodies when pedal is pulled toward released direction from unapplied position.

FRONT DISC BRAKES

10. Disc Brake Relining (Front)

Lining Inspection

Inspect the brake linings any time that the wheels are removed (tire rotation, etc.). Check both ends of the outboard shoe by looking in at each end of the caliper. These are the points at which the highest rate of wear normally occurs. However, at the same time, check the lining thickness on the inboard shoe to make sure that it has not worn prematurely. Look down through the inspection hole in the top of the caliper to view the inboard shoe. Whenever the thickness of any lining is worn to the approximate thickness of the metal shoe, all shoe and lining assemblies should be replaced.

Front disc brakes have a wear indicator that makes a noise when the linings wear to a degree where replacement is required, Fig. 5-13. The reed is in an integral part of the inboard shoe and lining assemblies. When the lining is worn the reed contacts the rotor and produces a warning noise.

Check flatness of brake linings. Place inboard and outboard lining surfaces together and check for gap between pad surfaces. If more than .012" gap is measured at middle of linings, linings must not be used. This applies to new or used brake linings.

Relining Procedure

1. Remove two thirds of the total fluid capacity in the rear master cylinder reservoir. Discard fluid.

(NOTE: Removing the fluid prevents reservoir overflow when the piston is pushed back in its bore to remove the caliper.)

BACK TO INDEX

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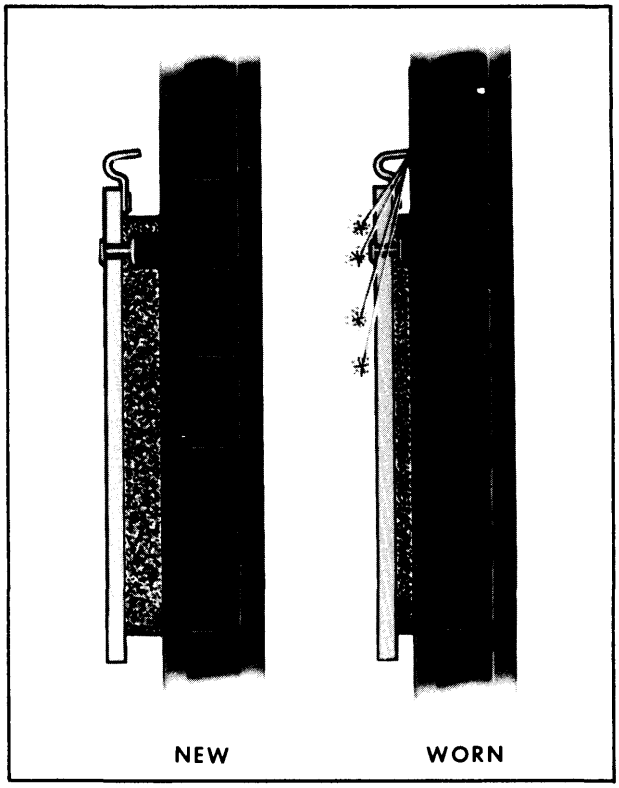


Fig. 5-13 Wear Indicator

2. Raise car and remove front wheels.
3. Position 7 inch "C" clamp on the caliper so that solid side rests against back of caliper assembly. The screw end rests against back of outboard shoe, Fig. 5-14.
4. Tighten "C" clamp until caliper moves out far enough to push piston to bottom of piston bore. This will release the pressure on shoe and lining assemblies.
5. Remove "C" clamp.
6. Remove two bolts, using a 3/8 head Allen Socket Assembly, that hold caliper to steering knuckle, Fig. 5-15.

(NOTE: It is not necessary to remove brake hose when relining disc brakes.)

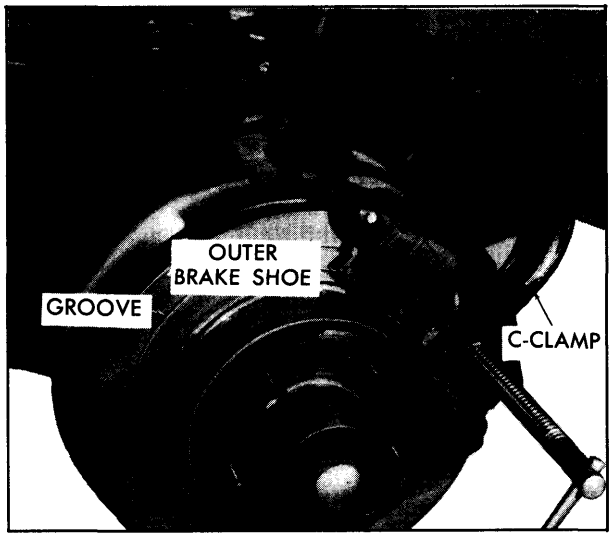


Fig. 5-14 Pushing Piston Into Bore

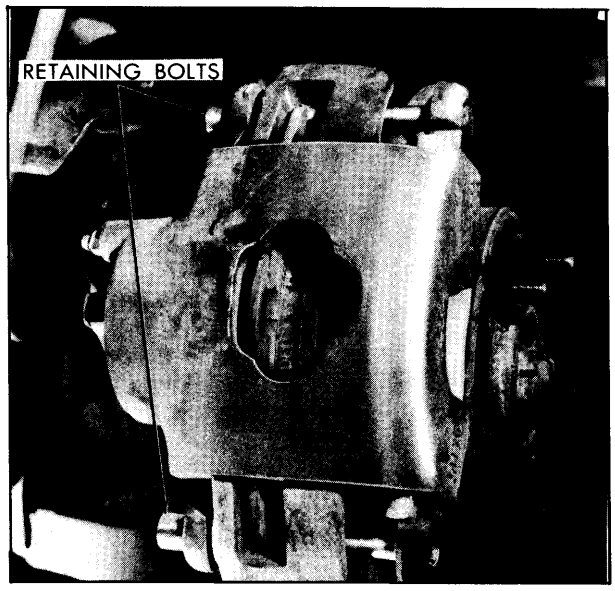


Fig. 5-15 Sliding Caliper Disc Brake

7. If working on Eldorado, it will be necessary to remove cotter pin, loosen upper spherical joint nut and slip brake hose collar out of its clip. The slack gained will permit removal of caliper without pulling hose.
8. Remove two bolts securing caliper to steering knuckle and slide caliper off rotor and support with a hook-shaped wire fastened to upper suspension arm.

CAUTION: Do not allow caliper to hang from brake hose, as damage may occur.

9. Remove inboard shoe and spring from piston.
10. Remove outboard shoe from caliper.
11. Push out two sleeves from inboard ears of the caliper.
12. Remove four rubber bushings, two on inboard ears and two on outboard ears.
13. Examine piston area for fluid leaks by looking for excessive moisture around boot area. Check dust boot for cuts, cracks or other damage which would affect its ability to seal piston bore. If leaks are present or boot shows damage, caliper should be overhauled as described in Note 13. If no problems are found, wipe clean the inside of the caliper including four ears where bushings are installed. Wipe the outside surface of the dust boot clear of all dirt so that when piston is pressed to bottom of bore, boot will fold back without coming out of groove in piston.

CAUTION: Do not use air for cleaning caliper because of the possibility of unseating dust boot.

14. Examine both sides of rotor for scoring or rough finish. Refer to Note 15 to determine condition of rotor. In normal use, a slight ridge or rust may form on the edge of the rotor. This ridge may be removed with sandpaper.
15. Make sure the piston is bottomed in the piston bore. Make sure the dust boot has folded back correctly as the piston moved back.
16. Wipe out grooves in caliper ears and install new rubber bushings.
17. Lubricate new bushings and sleeves with silicone

BACK TO INDEX

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lubricant. Install the sleeves and position the sleeve so that end toward the shoe and lining assembly is flush with the machined surface or the ear.

18. Secure clip-on spring to inner shoe inside cut-out section of piston. Install inboard shoe and lining assembly with wear indicator to rear of car.

(NOTE: With wear indicator there is a specific left hand and right hand inboard shoe.)

19. Place the outboard shoe and lining in the caliper so that the lining faces toward the rotor. The two ears at the ends of the shoe fit over the ears on the caliper. The flange on the bottom of the shoe fits into the cut-out section of the caliper.

20. Position caliper on rotor and line up holes in caliper ears with holes in steering knuckle. Make sure the brake hose is not twisted as its natural curvature is essential to maintain proper hose-to-suspension clearance through full movememt of suspension and steering parts.

21. Wipe all dirt and corrosion from the caliper mounting bolts. Do not use abrasives, as they will remove protective plating. Lubricate both ends of bolts with silicone lubricant.

22. Start either bolt into the inboard ear of the caliper and into the steering knuckle. At this point it is necessary to be sure that the bolt passes under the retaining ear on the inboard shoe to maintain the shoe in position in the caliper, Fig. 5-15.

23. Pass the bolt on through the outboard ear on the caliper and brake shoe until the threads on the bolt can be started into the steering knuckle.

24. Repeat steps 22 and 23 in placing remaining bolt into caliper assembly.

25. Tighten caliper mounting bolts, using a 3/8 Allen Head Socket Assembly to 30 foot-pounds.

(For steps 25, 29, 31.) *See CAUTION Page 5-8 prior to Note 6.*

26. Pump brake pedal to seat lining against rotor.

27. Clinch upper ear of outboard shoe by positioning 12" pliers with one jaw on top of upper ear and one jaw in notch on bottom of shoe, opposite upper ear, see Fig. 5-16.

(NOTE: After clinching, there should be no radial clearance between the shoe ears and caliper housing.)

28. If radial clearance exists, repeat clinching procedure.

29. If working on an Eldorado, center brake hose collar in clip and tighten upper spherical jount nut to 60 foot-pounds. Install cotter pin.

30. Repeat steps 3 through 28 on other brake assembly. Always reline both front brakes.

31. Install wheels, tighten wheel mounting nuts to 130 foot-pounds on Eldorados, 100 foot-pounds for all other cars and lower car.

See CAUTION on Page 5-8.

32. Before moving the vehicle, pump the brake pedal two or three times to insure firm pedal.

33. Allow car weight to be supported on front wheels and inspect front brake hoses for twisted condition. If necessary, correct as described in Note 24a and b.

34. Check the master cylinder reservoirs and fill to 1/8 to 3/8 inch from top.

35. Any time the front brakes are relined, the rear drum brakes should be checked.

36. Break in new linings as described in Note 11.

11. Break-In of New Linings (All)

New or replacement brake linings, if subjected to normal usage at speeds under 50 MPH need no special break-in. However, the first few brake applications may be somewhat erratic, and it may be necessary to stabilize the brakes before delivering the car to the owner. If brake action is erratic, one acceptable way to seat the brakes is to make five or ten moderate brake stops at speeds of 30 to 40 MPH, at approximately one-half mile intervals.

12. Disc Brake Caliper Assembly Front (All)

a. Removal

1. Remove two thirds of the total fluid capacity in the rear master cylinder reservoir. Discard fluid.

(NOTE: Removing fluid prevents reservoir overflow when the piston is pushed back in its bore to remove the caliper.)

2. Raise car and remove front wheels.

3. Position a "C" Clamp on the caliper so that solid side rests against back of caliper assembly. The screw end rests against back of outboard shoe, Fig. 5-14.

4. Tighten "C" clamp until caliper moves out far enough to push piston to bottom of piston bore. This will release the pressure on shoe and lining assemblies.

5. Remove "C" clamp.

6. Disconnect steel brake line from hose and cap fittings to prevent dirt from entering brake line or hose.

7. Remove U-shaped retainer from hose fitting and withdraw hose from frame support bracket. On Eldorado remove upper spherical joint cotter pin and nut. Slide hose clip off joint stud. On right side of Eldorado remove clip located at frame side bar and loosen hose at caliper.

8. Remove two bolts, using a 3/8 Allen Head Socket assembly, that hold caliper to steering knuckle.

9. Slide caliper off rotor.

10. Remove inboard shoe from caliper.

11. Outboard shoe may have disengaged itself from caliper as caliper was removed from rotor. If it did not disengage itself, remove outboard shoe.

12. Place caliper on clean workbench and remove hose and copper washer from caliper inlet fitting. Discard washer.

13. Overhaul caliper as described in Note 13.

b. Inspection of Rotor

1. With caliper assembly off rotor, inspect rotor as described in Note 15.

c. Installation

1. Connect brake hose to inlet hole on caliper using a new copper washer. Tighten to 30 foot-pounds maximum torque.

BACK TO INDEX

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2. Make sure piston is bottomed in piston bore. Make sure the dust boot has folded back correctly as piston moved back.

3. Secure clip-on spring to inner shoe inside cut-out section of piston. Install inboard shoe and lining assembly with wear indicator to rear of car.

(NOTE: There are left and right inboard shoes. They must be installed properly for wear indicator to operate.)

4. Place outboard shoe and lining in caliper so that lining faces toward rotor. The two ears at ends of shoe fit over ears of caliper. Flange on bottom of shoe fits into cut-out section of caliper.

5. Position on rotor and line up holes in caliper ears with holes in steering knuckle.

6. Lubricate both ends of caliper bolts with silicone lubricant.

7. Start either bolt into inboard ear of caliper and outboard ear of shoe into steering knuckle. At this point it is necessary to be sure that bolt passes under retaining ear on inboard shoe to maintain shoe in position in caliper, Fig. 5-15.

8. Pass bolt on through outboard ear on caliper until threads on bolt can be started into steering knuckle.

9. Repeat steps 7 and 8 in placing remaining bolt into caliper assembly.

10. Tighten caliper mounting bolts to 30 foot-pounds.

11. Pump brake pedal to seat lining against rotor.

12. Clinch upper ears of outboard shoe by positioning 12" pliers with one jaw on top of upper ear and one jaw in notch on bottom of shoe, opposite upper ear. Fig. 5-16.

(NOTE: After clinching, there should be no radial clearance between the shoe ears and caliper housing.)

13. If radial clearance exists, repeat clinching procedure.

14. Install wheel and tighten mounting nuts to 130 foot-pounds on Eldorados, 100 foot-pounds on all others.

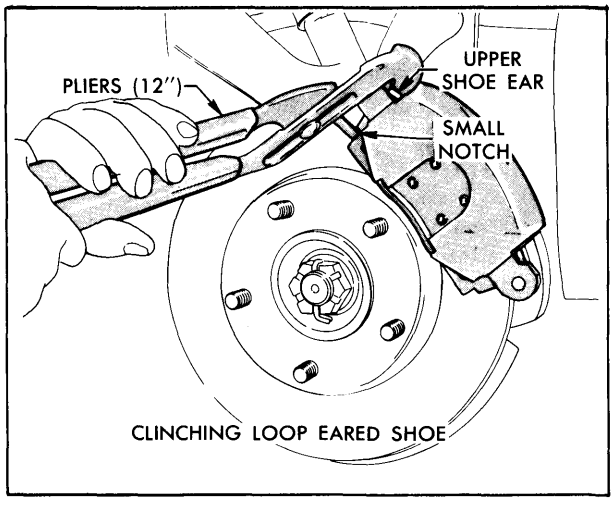


Fig. 5-16 Clinching Outboard Shoe

(For steps 10 and 14). See CAUTION on Page 5-8 prior to Note 6.

15. With suspension in normal position (Front wheel straight and vehicle weight on front wheels) pass female end of hose through frame support bracket, allowing hose to seek its own position. Insert hex of hose fitting into the 12-point hole in support bracket in position that will result in least twist in hose.

(NOTE: Do not twist hose any more than necessary during this operation as its natural curvature is essential to maintain proper hose-to-suspension clearance through full movement of suspension and steering parts.)

On Eldorado when assembling front brake hoses at the frame attachment bracket, the front standing height must be set to 13.50 inches as measured along shock absorber from centerline of top mounting bolt to centerline of bottom mounting bolt, before hose is assembled to bracket.

CAUTION: Hose must not be twisted when assembled as possible damage or interference may occur.

This measurement can be obtained by using Tool J-24842. Insert bottom of tool in lower suspension arm below shock mounting bracket. Compress suspension and insert top of tool into upper shock mounting bracket, Fig. 5-68.

16. Install U-shaped retainer to secure hose in frame support bracket. On Eldorado install hose and clip on upper spherical joint stud. Install nut. Torque to 60 foot-pounds and insert cotter pin.

17. Inspect by turning steering from stop-to-stop while observing hose position. Be sure that hose does not touch other parts at any time during steering travel. If contact does occur, remove hose retainer and rotate female hose end in support bracket one or two points in appropriate direction, replace retainer, and re-inspect.

18. Place steel tube connector nut in hose fitting and tighten to 20 foot-pounds maximum torque.

19. Bleed all brakes as outlined in Note 6.

20. Before moving car, pump brake pedal two or three times to insure a firm pedal.

13. Disc Brake Caliper Disassembly, Cleaning, Inspection and Assembly (All)

a. Disassembly

1. Remove caliper assembly as described in Note 12a.

2. Clean the caliper exterior with denatured alcohol.

3. Push out two sleeves from inboard ears of the caliper.

4. Remove four rubber bushings, two on inboard ears and two on outboard ears.

5. Place a pad of clean shop towels or wood block on caliper bridge, Fig. 5-17.

(NOTE: The towels will prevent damaging the piston when it is pushed out by air pressure.)

6. Use service air hose to apply moderate air pres-

BACK TO INDEX

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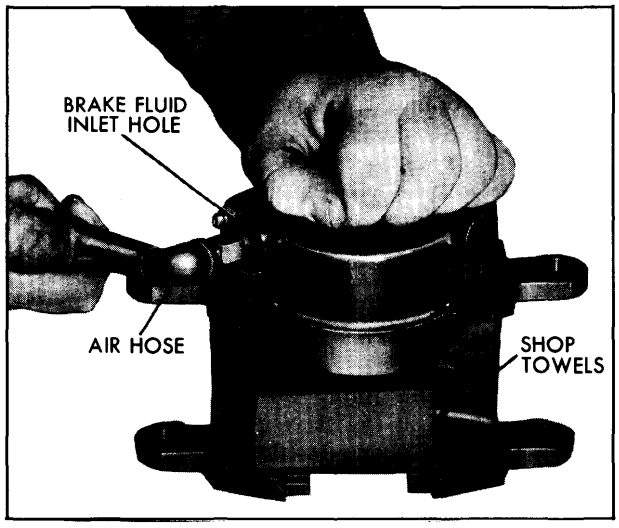


Fig. 5-17 Removing Piston

sure to brake fluid inlet hole to force piston out of caliper. Keep fingers clear of piston.

CAUTION: Use clean air only. Air supplies that are lubed or oiled contain mineral oil that will damage rubber parts.

7. Using a screwdriver, pry boot out of housing, being careful not to scratch bore, Fig. 5-18. Discard boot.

8. Using a plastic toothpick, remove piston seal from groove in bore and discard seal.

CAUTION: Do not use any metallic device to remove the seal, as it may scratch or damage the bore or groove.

9. Remove bleeder fitting from caliper assembly.

b. Cleaning and Inspection

1. Inspect the caliper brake hose for worn spots, cracks or other signs of deterioration. Replace if necessary.

2. Inspect the piston for scoring, pitting, nicks, corrosion and worn or damaged chrome plating. If any of these faults appear, it will be necessary to replace the piston.

3. The bore should be inspected for the same faults as the piston with the exception of chrome plate. Stains or corrosion can be polished with fine crocus cloth. Wash caliper bore with clean denatured alcohol. If the faults cannot be cleaned up in this manner, it will be necessary to replace the caliper.

4. All passageways should be blown out with clean air.

5. Clean the caliper mounting bolts and caliper ear grooves of all dirt and corrosion. Do not use abrasives on bolts, as they will remove protective plating.

c. Assembly

1. Install bleeder fitting in caliper.

2. Lubricate piston bore and new piston seal with brake fluid.

3. Position the new seal in the groove in the piston bore.

4. Assemble new dust boot on piston, so that inner diameter of boot is secured in groove and boot fold faces away from closed end of piston, Fig. 5-19.

(NOTE: Do not use previously removed boot.)

5. Lubricate sealing surface of piston with brake fluid. Position piston in bore and press it down to bottom of bore. Make certain dust boot does not disengage from groove in piston.

6. With dust boot evenly positioned in caliper counterbore, position Boot Installer, J-22904, on boot and tap with a plastic hammer to seat boot, Fig. 5-20.

7. Lubricate four new bushings with silicone lubricant and install bushings in caliper ears.

8. Lubricate new sleeves with silicone lubricant and install in inboard caliper ear. Position the sleeve so that end toward the shoe and lining assembly is flush with the machined surface of the ear.

9. Install caliper assembly as described in Note 12c.

14. Hub and Rotor Assembly

a. Removal

1. Remove wheel disc and loosen wheel mounting

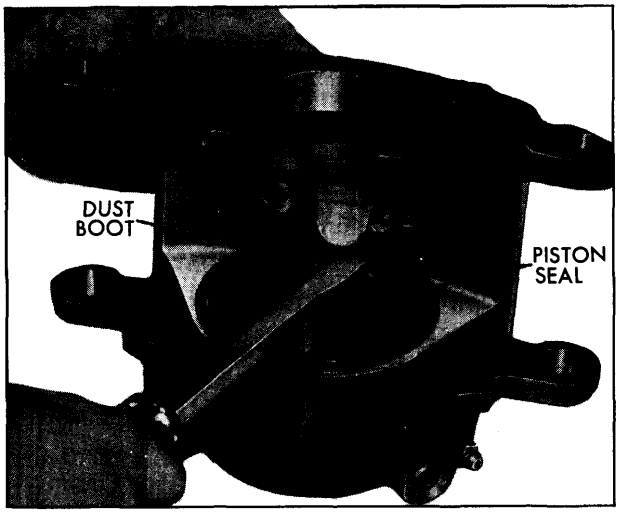


Fig. 5-18 Removing Dust Boot

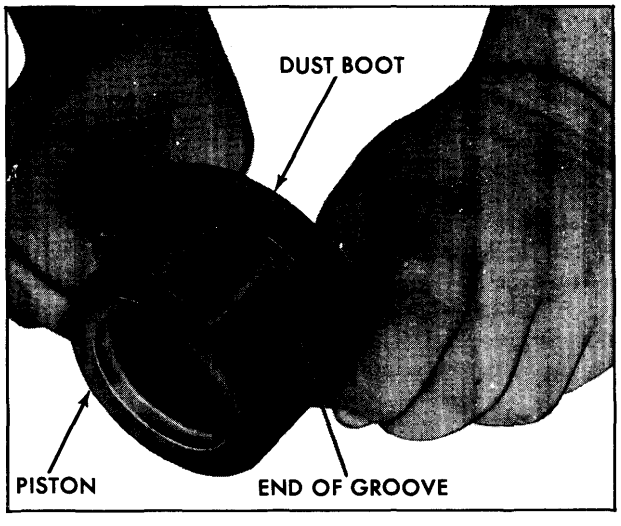


Fig. 5-19 Assembling Dust Boot on Piston

BACK TO INDEX

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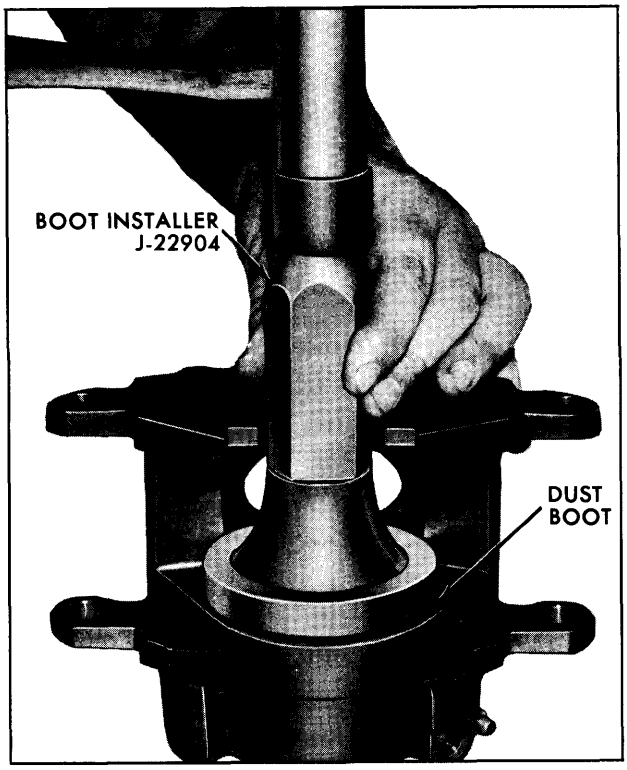


Fig. 5-20 Installing Dust Boot in Caliper

nuts on side from which hub and rotor is to be removed.

2. Raise front end of car and place jack stands under front frame side rails.

3. Remove wheel mounting nuts and remove wheel and tire.

4. Remove two bolts securing brake caliper to steering knuckle. Slide caliper off rotor and use a piece of wire to attach caliper to upper suspension arm.

CAUTION: Never allow caliper to hang from brake hose, as damage may occur.

5. Remove dust cap, cotter pin, spindle nut, and washer.

6. Remove outer cone and bearing assembly.

7. Remove hub and rotor assembly from steering knuckle spindle.

b. Installation

1. Install hub and rotor assembly on spindle.

2. Install bearing assembly, washer and spindle nut, tightening nut with fingers.

3. Adjust wheel bearings as in Section 3 Note 17a.

4. Install caliper following Steps 3 through 10 of Note 12c. Pump brake pedal two or three times to insure a firm pedal.

5. Install wheel and tire and install wheel mounting nuts finger tight.

6. Raise car, remove jack and jack stands, and lower car.

7. Tighten wheel mounting nuts to 130 foot-pounds on Eldorados, 100 foot-pounds on all others.

8. Install wheel disc.

15. Servicing Front Rotors

When performing any service on front disc brakes, inspect the rotor ventilation passages for obstructions, such as salt or mud build-up. Any build-up must be removed because it decreases brake cooling, which might lead to increased lining wear rate and brake shudder.

When new linings are installed, the rotor should be lightly sanded using a circular non-directional motion. A slight ridge of rust may form on the edge of the rotor, during normal use. This ridge should be removed during the sanding operation.

Scoring of the rotor, due to advanced wear of linings, does not always necessitate replacement of the rotor. Rotors with scoring of the surface up to approximately .020 inch in depth are not detrimental to brake operation and may be used with new linings.

Once a wear pattern has been established, front disc brake cars are not as susceptible to problems occurring because of scored rotors as front drum brake cars are due to scored drums.

In normal servicing of worn lining or on caliper removal, lateral runout of the rotor need not be checked, except when brake shudder is evident.

If brake shudder develops after long periods of use, it may be caused by light surface deposits (such as lining oxides) on the braking surface of the rotor. These deposits, which appear as a dark blotch about the size of half-dollars, may be removed by sanding.

Brake shudder may be caused by excessive rotor lateral runout or out-of-parallelism.

Before checking runout and parellelism, check rotor thickness. If total rotor thickness is less than 1.215 inch on all except the Eldorado or 1.190 inch on the Eldorado, the rotor must be replaced. Some rotors may already be at minimum thickness, so the rotors must be checked before attempting a refinishing operation.

When checking runout of the "C" car, first tighten front wheel bearing to take up end play. If "C" car lateral runout is in excess of .005 inch, or parallelism is in excess of .0005 inch, the rotor should be refinished or replaced.

On the Eldorado, lateral runout of the hub and rotor assembly must not exceed .008 inch or parallelism .0005 inch. If these specifications are exceeded, the rotor should be refinished or replaced. When checking runout on this car, the wheel nuts must be installed with the flat portion of the hex against the rotor to retain the rotor against the hub.

The hub and rotor assembly (except Eldorado), is a cast integral unit and is not interchangeable with the Eldorado hub and rotor. The Eldorado hub and rotor are replaceable separately. On all cars it is not necessary to replace both front hub and rotor assemblies when only one is faulty. Replace only faulty hub and rotor.

Since extremely accurate control of the finishing operation is necessary for proper performance, refinishing of the rubbing surface is not recommended unless precision equipment is available and surfaces can be held within specifications listed.

BACK TO INDEX

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REAR DRUM BRAKES

16. Rear Drum Brake Shoe Assemblies

When brake relining is necessary, it is recommended that the complete brake shoe and lining assemblies be replaced with new assemblies. New shoe and lining assemblies are precision-ground to fit the drum diameter, minimizing the possibility of imperfect braking action due to warped brake shoes or partial contact between linings and drum.

Those Service Departments that have adequate brake shoe relining equipment may obtain linings, drilled and cut to size, from their servicing Parts Distribution Center. Brake lining grinding equipment should incorporate brake shoe holders that locate the shoes accurately in relation to the anchor end, as brake anchors are not adjustable and require accurately ground linings.

17. Relining Rear Drum Brakes (Fig. 5-21)

1. Release parking brake, raise car, and remove rear wheels.
2. Remove rear brake drum assemblies.
3. Loosen parking brake cable locknut on equalizer.
4. Remove primary brake shoe retracting spring, using Brake Spring Remover and Installer, J-8049.
5. Disconnect link at anchor and remove link, secondary brake shoe retracting spring, and anchor plate.
6. Remove primary brake shoe hold-down cup, spring and pin, and secondary brake shoe hold-down pin, cup, spring, and sleeve.
7. Remove pawl return spring, actuating lever, and pawl.

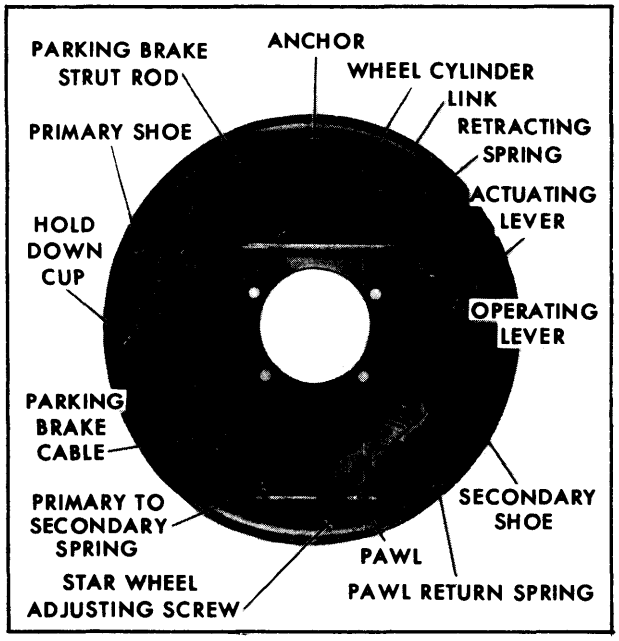


Fig. 5-21 Rear Wheel Drum Brake Mechanism

8. Disengage brake shoes from wheel cylinder connecting links and parking brake strut rod. Remove strut rod and spring.
9. Disconnect parking brake cable from operating lever on secondary shoe and remove complete shoe and lining assembly from brake backing plate.
10. Remove star wheel adjuster and primary to secondary connecting spring from shoe assembly.
11. Remove clip from pin on secondary brake shoe and remove operating lever and pin assembly.
12. Clean brake backing plate and all brake parts.

CAUTION: Make certain that hands are clean when handling brake parts and avoid handling friction surfaces of drums and linings as possible contamination may occur.

13. Tighten nuts that hold backing plate to rear axle housing to 40 foot-pounds maximum torque.
See CAUTION page 5-8 prior to Note 6.
14. Install operating lever and pin assembly on replacement secondary brake shoe and secure with clip.
15. Lubricate threads and socket of star wheel adjuster and points of contact between brake and other brake parts with a heat resistant lubricant, part number 1050110 or its equivalent. Use sparingly, especially on brake shoe pads.
16. Thread star wheel adjusting screw completely into pivot nut to permit installation of brake drum over replacement brake shoes.
17. Install star wheel adjuster and primary-to-secondary connecting spring on brake shoes. Make certain that star wheel rotates in proper direction.

(NOTE: Maroon springs are used on both left and right hand rear brake shoe assemblies. These springs are interchangeable.)

Star wheel adjusters with three wide grooves on O.D. of pivot nut (left hand threads) Fig. 5-22 are installed on right side of car and those with three narrow grooves on O.D. of pivot nut (right hand threads) must be installed on left side.

18. Position shoe assembly on brake backing plate and connect parking brake cable to operating lever.

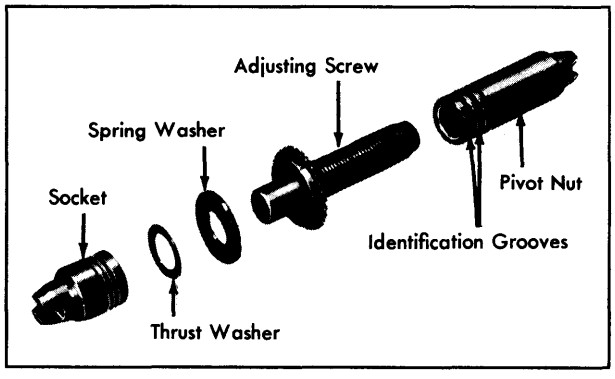


Fig. 5-22 Star Wheel Adjuster Disassembled

BACK TO INDEX

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19. Install parking brake strut rod and spring on brake shoe assembly.

(NOTE: Light blue spring is used on left side and white spring on right side. These springs are not interchangeable. Spring tab must be positioned outside of brake shoe web on both rear brakes.)

20. Engage shoes with wheel cylinder connecting links and install hold-down pin, cups, and spring on primary brake shoe.

(NOTE: Maroon primary and blue secondary hold-down springs are used on the rear brake assemblies.)

21. Position actuating lever and pawl so that actuating lever is on top of secondary brake shoe. Secure with hold-down pin, sleeve, spring, and cup.

22. Install anchor plate, link, and secondary brake shoe retracting spring (yellow). For easiest installation, first connect spring to link then install link on anchor, using brake Spring Remover and Installer, J-8049.

23. Install pawl return spring. Make certain that star wheel engages pawl.

24. Install primary brake shoe retracting spring (red) using Spring Installer, J-8049.

25. Perform preliminary service brake adjustment as described in Note 7.

26. Install rear brake drums on rear axle shaft flange and secure with screw.

27. Install wheels on brake drums. Tighten wheel mounting nuts to 100 foot-pounds.

See CAUTION page 5-8 prior to Note 6.

28. Adjust parking brake as described in Note 8.

18. Machining Brake Drums

a. Warped or Scored

Brake drums should be carefully checked to see if they have become warped or scored excessively. If they appear salvageable and if suitable equipment is available, they can be machined.

Drum machining is a precision operation. Equipment used for this purpose must be capable of maintaining the close limits specified. Be sure to install drum in the machining equipment correctly and to check runout of lathe spindle to insure accuracy of final machining operation. Inside drum diameter must not be machined over 12.060 inches on all cars. Should brake drums be machined too thin, the intense heat that develops under severe driving conditions will cause them to distort, crack or wrap.

In addition, the specifications listed on page 5-33 must be held.

Replacement brake drums supplied by your servicing Parts Warehouses are machine-finished at the factory before being shipped. They do not require any further finishing before installation, but they must be thoroughly cleaned with a non-oil base solvent to remove all traces of the oil or grease used for rust-proofing during storage and transit. Do not machine drums to roughen the braking surface. Use coarse emery cloth for this purpose;

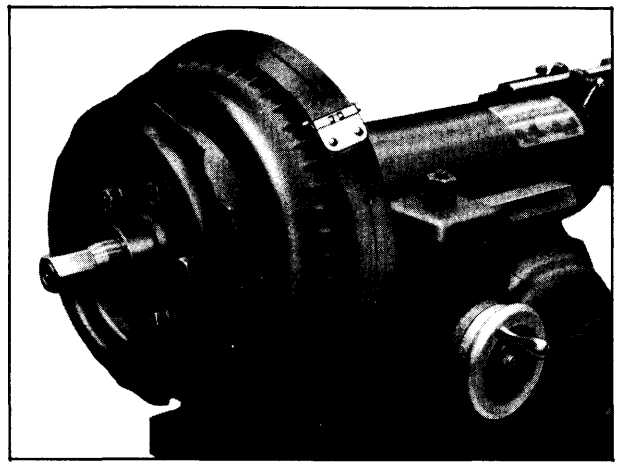


Fig. 5-23 Assembly Mounted on Lathe

b. Brake Shudder (All Except Eldorado)

Brake shudder may be experienced during light pedal application just as the car is braked to a stop. The shudder, sometimes called "footballing", chatter, or surge, may be caused by improper fit of the rear brake drum to the rear axle shaft, resulting from the mounting face of the drum being out-of-flat.

The out-of-flatness and resultant roughness or "footballing" condition of the rear brake drums can usually be eliminated by turning the suspected drum while it is clamped between a front wheel hub and a wheel spider assembly. (Fig. 5-23)

The entire procedure for drum-turning is as follows:

1. Wipe drum inner mounting surface and front hub surface clean of all metal chips, dust or foreign matter.
2. Install drum causing roughness or shudder between front hub, and wheel spider section, Fig. 5-24 securing with five wheel attaching nuts. Torque nuts to 50 foot-pounds, using a criss-cross pattern of tightening.
3. Turn drum on a lathe in usual manner that a drum would be turned, Fig. 5-25.
4. After turning drum, unbolt assembly and remove drum. Drum is now ready for installation on car and roadtesting to confirm correction of brake roughness or shudder.

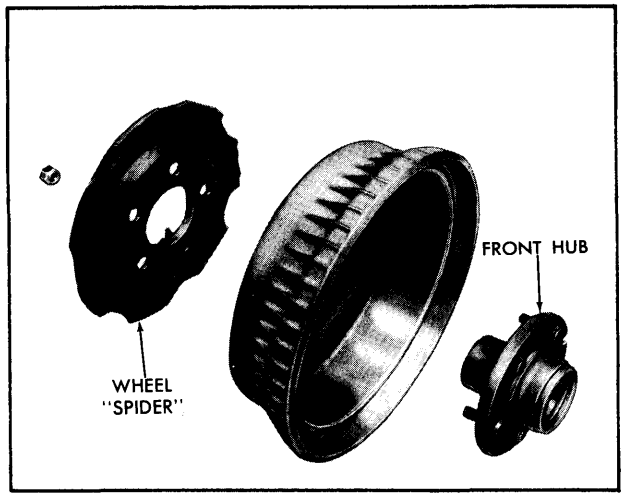


Fig. 5-24 Assembling Spider & Hub To Drum

BACK TO INDEX

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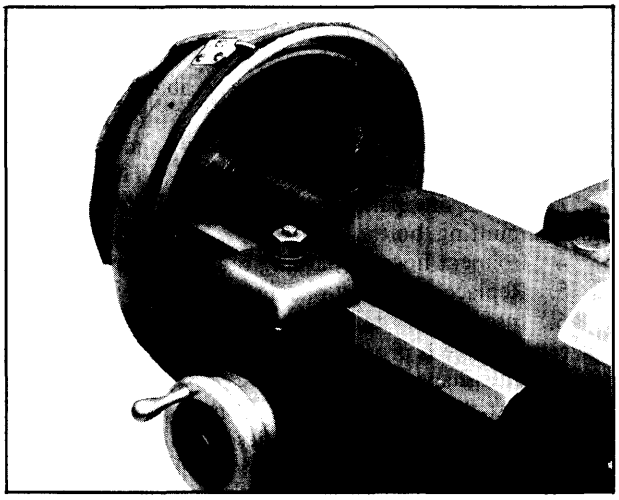


Fig. 5-25 Turning Drum

This procedure can be used for all Cadillac rear drums that exhibit brake shudder, and all past model front drums regardless of the make of drum.

(NOTE: Front drums of past models have the hub assembled so only the wheel spider need be mounted on these drums before turning.)

Though the front wheel, tire, hub and drum of past models can be removed from the car as an assembly and turned as an assembly on some lathes, it is recommended the tire and wheel assembly be removed from the drum, and the wheel spider be installed before turning. This permits greater ease of handling and places less weight on the drum lathe spindle bearings.

19. Wheel Cylinder Servicing

a. Removal

1. Raise car and remove wheel and brake drum. Vacuum out dust and dirt from drum and linings.
2. Disconnect hydraulic brake piping from wheel cylinder.
3. Remove brake shoe retracting springs and link.
4. Remove two screws holding wheel cylinder to backing plate.
5. Disengage wheel cylinder connecting links from brake shoes and remove wheel cylinder.

CAUTION: Be sure brake fluid does not drip on brake lining, as fluid may damage linings.

b. Disassembly (Fig. 5-26)

1. Remove connecting links and rubber boots from ends of wheel cylinder.
2. Slide pistons and piston cups from either end of cylinder.
3. Remove piston cups, spring and expander assembly.
4. Remove bleeder screw assembly.

c. Cleaning and Parts Replacement

With clean hands, wash all parts except pistons in clean alcohol. Wipe pistons with clean dry cloth. Inspect surface of cylinder bore and hydraulic passages. Replace wheel cylinder if any obstructions are observed in holes or if there are any nicks or burrs in bore.

If it is necessary to replace any of the wheel cylinder assembly parts, refer to parts book for replacement parts.

d. Assembly (Fig. 5-26)

1. Install bleeder screw assembly.
2. Install piston cup in one end of cylinder with lip toward center, and install piston with flat side toward cup.
3. Install rubber boot into end of wheel cylinder.
4. Install spring and expander assembly.
5. Install other piston cup, lip toward center. Install piston, flat side toward cup.
6. Install remaining rubber boot into end of cylinder.

e. Installation

1. Position wheel cylinder on brake backing plate, slipping cylinder-to-shoe connecting links in place at same time.

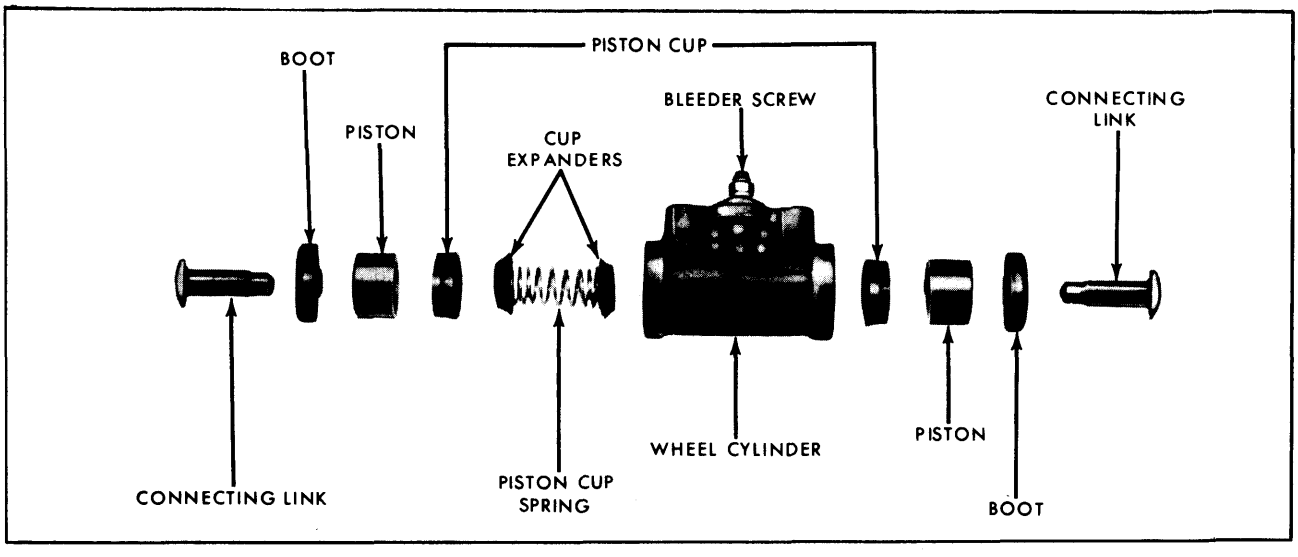


Fig. 5-26 Wheel Cylinder Disassembled

BACK TO INDEX

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2. Install two screws holding wheel cylinder to backing plate. Tighten to 15 foot-pounds maximum torque.

See CAUTION on page 5-8 prior to Note 6.

3. Install brake shoe retracting springs and link.

(NOTE: Avoid handling friction surfaces of drums and linings.)

4. Connect brake piping to wheel cylinders.
5. Install brake drum and wheel assembly and torque wheel mounting nuts to 100 foot pounds.
6. Bleed all brakes as described in Note 6.

20. Parking Brake Pedal Assembly

a. Removal

1. Remove steering column lower cover as explained in Section 12, Note 41a.
2. Place parking brake pedal in release position. Set transmission shift lever in Park position.
3. Working underneath car, remove equalizer nut and washer and separate cable stud from equalizer.
4. Disconnect parking brake vacuum hose at cylinder.
5. Position carpet and left cowl kick-pad out of the way.
6. Working from under hood remove two parking brake assembly-to-cowl mounting nuts.
7. Remove one parking brake assembly-to-instrument panel mounting bolt and move assembly away from cowl.
8. Position brake pedal lever so that clevis on parking brake assembly is exposed, and remove brake cable end from clevis.

b. Installation

1. Position parking brake pedal so that clevis is exposed, and attach parking brake cable to clevis on parking brake assembly.
2. Install parking brake assembly and secure to cowl with two mounting nuts.
3. Install one parking brake assembly-to-instrument panel mounting bolt.
4. Connect hose to parking brake vacuum cylinder.
5. Replace cowl kick-pad and carpet.
6. Insert cable stud through equalizer, making sure the center cable is properly routed through equalizer and secured at C-shaped clamp, Fig. 5-27.
7. Install washer and equalizer nut.
8. Adjust parking brake as described in Note 8.
9. Check operation of automatic release.
10. Install steering column lower cover, as explained in Section 12, Note 41b.

21. Parking Brake Vacuum Diaphragm

a. Removal

1. Remove parking brake pedal assembly as described in Note 20a.
2. Drill out one rivet that retains cylinder and bracket to parking brake assembly.
3. Detach link that connects cylinder to manual release lever and remove cylinder.

b. Installation

1. Position cylinder and bracket on parking brake assembly and secure with one rivet or bolt and nut.
2. Secure link to manual release lever.

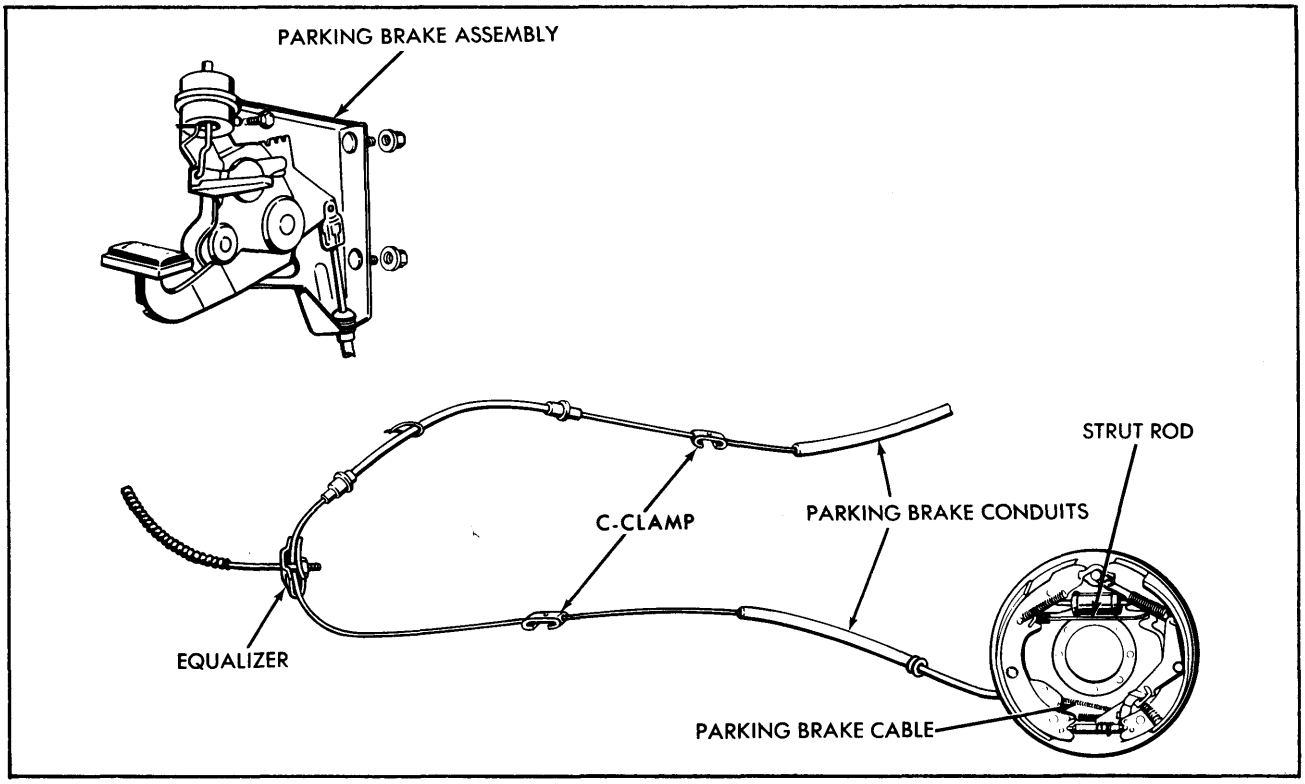


Fig. 5-27 Parking Brake Linkage

BACK TO INDEX

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3. Install parking brake assembly as described in Note 20b.
4. Test lock and automatic release operations with engine running in Neutral and Drive ranges.

(NOTE: Parking brake should release in any drive range with engine running, and should remain engaged in Neutral and Park with engine running.)

22. Parking Brake Cable (Fig. 5-27)

a. Removal (Front Cable)

1. Release parking brake.
2. Disconnect cable stud at equalizer by removing equalizer nut and separating cable stud from equalizer.
3. Remove U-shaped retainer at frame.
4. Remove U-shaped retainer at pedal assembly.
5. Remove cable end from parking brake assembly clevis.
6. Pull cable through hole in frame and remove from car.

b. Installation (Front Cable)

1. Insert cable through hole in body.
2. Install cable end into clevis in pedal assembly.
3. Install U-shaped retainer at pedal assembly.
4. Install cable grommet into hole in body.
5. Insert cable through hole in frame.
6. Install U-shaped retainer.
7. Connect cable stud at equalizer by installing nut. If working on an Eldorado thread cable through center crossmember.
8. Adjust parking brake as outlined in Note 8 for all except Eldorados and Note 40 for Eldorados.

c. Removal — Center Cable — Except Eldorado

1. Release parking brake.
2. Remove equalizer nut from cable stud and remove equalizer.
3. Remove retainer securing cable conduit at cross member and remove cable from bracket.
4. Remove wire guide from cross member.
5. Remove retainer from right body bracket and remove cable from bracket.
6. Remove wire guide from left frame side rail.
7. Remove cable from right and left connectors and remove cable.

d. Installation — Center Cable — Except Eldorado

1. Install cable in right and left connectors.
2. Install wire guide securing cable to left frame side rail.
3. Install cable conduit in right body bracket and secure with retainer.
4. Install wire guide securing cable conduit at cross member.
5. Install cable conduit in bracket at cross member and secure with retainer.
6. Install cable in equalizer and secure to cable stud with nut.
7. Adjust parking brake as described in Note 8.

e. Removal — Rear Cables (Except Eldorado)

1. Release parking brake.
2. Raise rear of car and place on jack stands.
3. Remove rear wheel and drum on same side of car as parking brake cable being replaced.
4. Remove equalizer nut and separate equalizer from front cable stud.
5. Remove end of cable being replaced from C-connector.
6. Remove clip securing cable to control arm bracket and remove cable from bracket by pulling rearward.
7. Remove two screws securing parking brake cable clamp to brake backing plate.
8. Remove pawl spring and pawl lever from actuating lever.
9. Remove cable end from operating lever, and remove cable from backing plate.

f. Installation—Rear Cables (Except Eldorado)

1. Route cable end through rear of backing plate and install on operating lever.
2. Install pawl lever and pawl spring.
3. Position parking brake cable clamp against backing plate, securing with two screws. Tighten screws to 11 foot-pounds maximum torque.

See CAUTION on page 5-8 prior to Note 6.

(NOTE: Pull on cable and check operation of cable and brake shoes by pulling on front end of cable to be sure cable is not bound.)

4. Route cable over top of rear suspension lower control arms.
5. Insert cable through hole in control arm bracket and secure with clip.
6. Install cable end in C-shaped connector.
7. Insert front cable stud through equalizer hole and install equalizer nut.
8. Install rear drum and wheel and torque wheel mounting nuts to 100 foot-pounds.
9. Adjust parking brake as described in Note 8.

HYDRAULIC LINES

23. Brake Combination Valve (Except Eldorado)

a. Removal

1. Disconnect wiring connector from valve.
2. Disconnect three brake pipes from top and one from front of valve.
3. Raise car and disconnect remaining brake pipe from bottom of valve.
4. Remove two bolts securing valve to frame and remove valve.

b. Installation

1. Position valve to frame and secure with two bolts.

BACK TO INDEX

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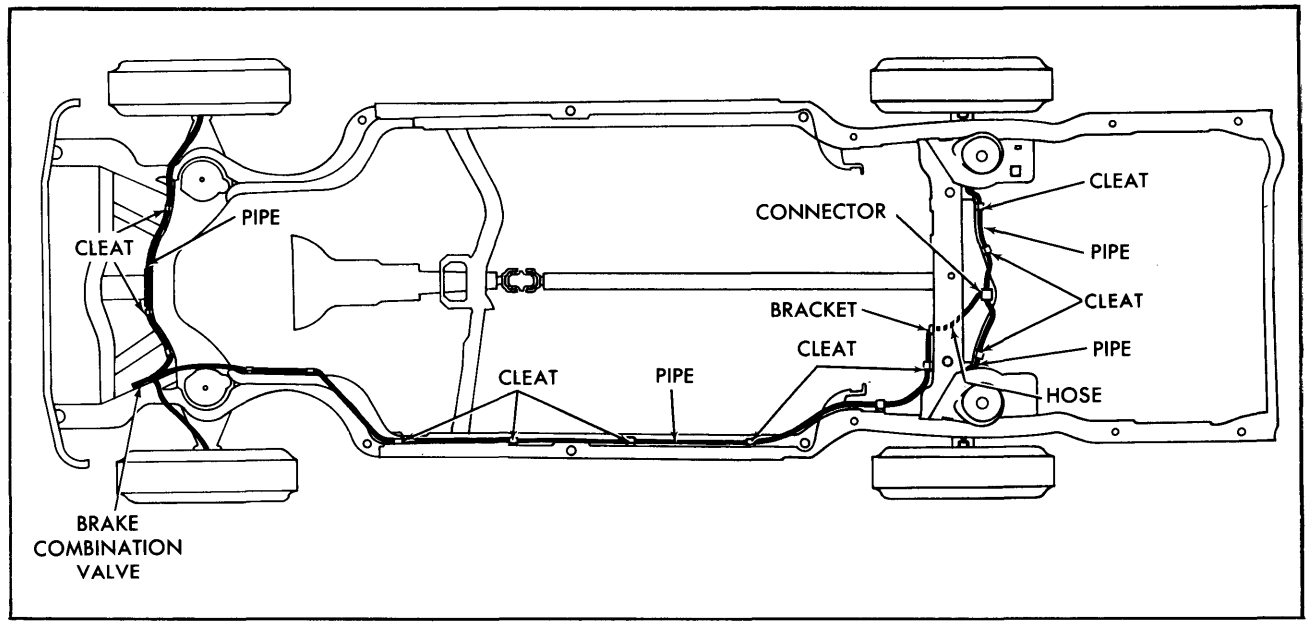


Fig. 5-28 Hydraulic Brake Lines

2. Install brake pipe to bottom of valve.
3. Lower car.
4. Install one brake pipe to front of valve and three on top.
5. Connect wiring connector to valve.
6. Bleed brakes as described in Note 6.

(NOTE: When replacing a combination valve, rear brake bleeding can be accomplished by allowing brake fluid to flow from the rear brake pipe nut at the valve. Back off this nut one turn and catch fluid flow in a cloth or a container until air is eliminated.

The front brakes should be bled at the calipers in the usual manner. Then, before driving car be sure a firm pedal is obtained.)

24. Servicing Hydraulic Brake Hoses and Piping — (All Except Eldorado, Fig. 5-28)

The brake system should be checked visually each time the car is lubricated. When the car is raised on a lift for lubrication, brake lines, hoses, and cables should be inspected for proper attachment, leaks, cracks, chafing, deterioration, etc.

The brake hoses should be carefully inspected for cracks in the rubber cover (360° around) at either end of the hose near the fittings by flexing the hose while inspecting it. Adequate lighting and a mirror are essential tools for a good inspection. This inspection is made easier by steering the wheels to a full turn and/or removing the front wheels. If any cracks, chafing, or leaks of the brake hose are detected, the brake hose should be replaced.

a. Removal—Hydraulic Brake Hose (Front Wheels)

1. Disconnect steel brake line from hose. Cap fitting to prevent dirt from entering brake line.
2. Remove U-shaped retainer from hose fitting and withdraw hose from frame support bracket.
3. Turn hose fitting out of caliper inlet and remove copper gasket. Discard gasket. If hose is to be reinstalled, cover end fittings to prevent dirt from entering hose.

b. Installation—Hydraulic Brake Hoses (Front Wheels)

1. Install new copper gasket on caliper end of hose (male end). Tighten hose in caliper inlet to 30 foot-pounds maximum torque.

CAUTION: Never tighten hose in caliper inlet with hose attached at frame ends as this will twist the hose and could cause damage.

2. With suspension in normal position (front wheels straight ahead) pass female end of hose through frame support bracket, allowing hose to seek its own position. Insert hex of hose fitting into the 12-point hole in support bracket in position that will require the least twist in hose.

(NOTE: Do not twist hose any more than necessary during this operation as its natural curvature is essential to maintain proper hose-to-suspension clearance through full movement of suspension and steering parts.)

3. Install U-shaped retainer to secure hose in frame support bracket.
4. Inspect by turning steering from stop-to-stop while observing hose position be sure that hose does not touch other parts at any time during steering travel. If contact does occur, remove hose retainer and rotate female hose end in support bracket one or two points in appropriate direction, replace retainer, and reinspect.
5. Place steel tube connector nut in hose fitting and tighten to 20 foot-pounds maximum torque.
6. Bleed all brakes as outlined in Note 6.

c. Removal—Hydraulic Brake Hose (Rear Wheels)

1. Disconnect brake pipes from hose. Cap pipes to

BACK TO INDEX
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prevent entry of dirt or foreign matter into system.

2. Remove retainer securing forward end of hose to frame or bracket.

3. Remove screw securing hose to axle bracket.

d. Installation—Hydraulic Brake Hose (Rear Wheels)

1. Thread rear axle pipes into hose.

2. Install brake hose mounting screw and torque to 12 foot-pounds.

3. Pass forward end of hose through mounting hole in frame or bracket allowing hose to seek its own position. Insert barrel end of hose fitting into barrel hole in mounting bracket and install retainer.

4. Remove line caps and tighten pipe nuts to 20 foot-pounds maximum torque.

5. Bleed brakes as described in Note 6.

e. Removal—Hydraulic Brake Piping (Rear Wheels)

1. Disconnect steel brake piping at rear wheel cylinder fitting. Cap fitting to prevent dirt from entering wheel cylinder.

2. Disconnect brake piping at brake hose on axle housing.

3. Unbend the welded retainer(s) on axle housing, and remove piping.

4. Remove screw securing pipe cleat to upper control arm bracket (R.H. only), remove piping.

f. Installation—Hydraulic Brake Piping (Rear Wheels)

1. Install steel piping on welded retainers.

2. Connect piping at brake hose and tighten to 20 foot-pounds maximum torque.

3. Connect piping at wheel cylinder fitting, tightening to 20 foot-pounds maximum torque.

4. Bend welded retainer(s) over piping enough to secure, being careful not to damage brake piping.

5. Install screw and pipe cleat securing piping to R.H. upper control arm bracket.

6. Bleed all brakes as outlined in Note 6.

25. Hydraulic Brake Tubing

Hydraulic brake tubing is a double layer annealed steel terne plate tubing which resists corrosion and has the physical strength to stand up under the high pressures which are developed when applying the brakes. In making up hydraulic brake pipes, it is recommended that Flaring Tool No. J-23530 be used to double-lap flare the ends of the tubing. Unless the tubing is properly flared, the connections may leak and the brakes could become ineffective.

CAUTION: When necessary to replace brake tubing, always use special steel tubing which is designed to withstand high pressure and resist corrosion. Ordinary copper tubing is not satisfactory and should not be used.

This safety steel tubing must be double-lap flared at the ends in order to produce a strong leak-proof joint.

Figure 5-29 shows two pieces of tubing, one with single-lap flare "A" and the other with double-lap flare "B". It will be noted that the single-lap flare in "A" split the tubing while the one shown in "B" is well-formed and unbroken due to the reinforcement of the double wall.

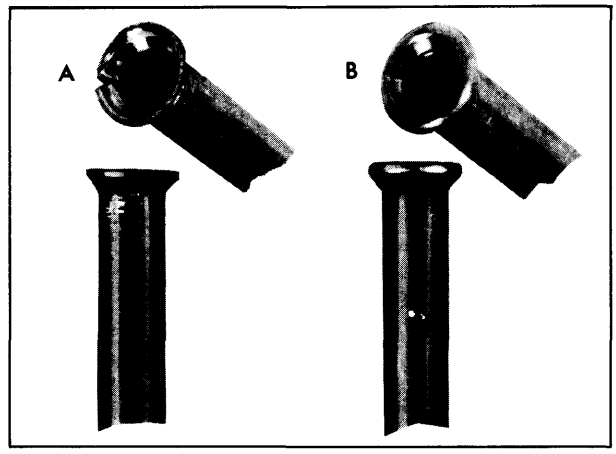


Fig. 5-29 Single and Double Lap Flare

The following procedure should be followed in making up hydraulic brake pipes.

26. Double Lap Flaring

1. Cut the tubing to the desired length.

2. Cut end square and clean burrs from inside and outside of tubing to be flared.

3. Using Tool No. J-23530, unscrew compression screw until swivel cone is at its highest point; swing strap to one side.

4. Open lever handle so it is at right angle to rest of tool, and revolve hexagonal tube clamps to accommodate tubing. (Selection of six sizes).

5. Be sure tubing nut is properly placed on tubing. Insert end of tube between two blocks until level with top of gage, Fig. 5-30.

6. Insert proper pin of gage into tubing and swing strap back in closed position. Tighten compression screw until gage bottoms on tool, Fig. 5-31, then unscrew compression screw and swing strap to one side. Remove gage.

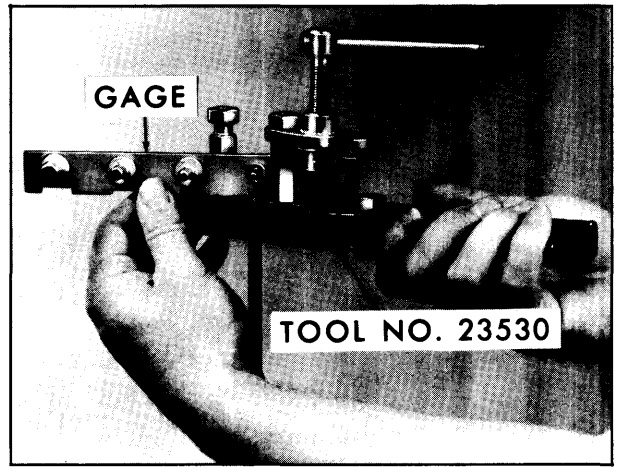


Fig. 5-30 Placing Tubing in Tool

BACK TO INDEX

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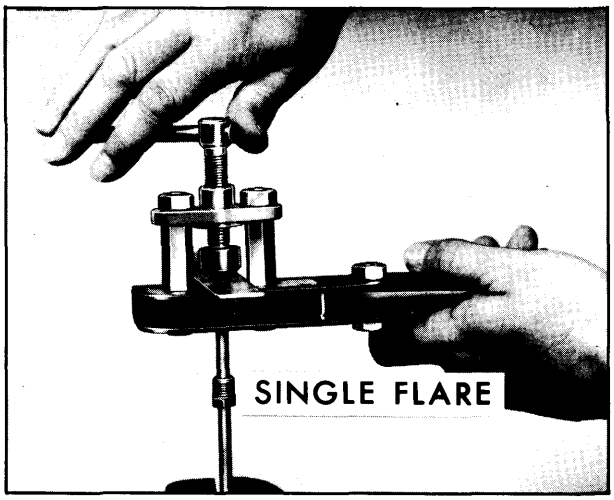


Fig. 5-31 Preparing for Double Lap

7. Swing strap back in closed position, then tighten compression screw to flare cone downward to complete double-lap flare, Fig. 5-32.

8. Unscrew compression screw and open smaller lever handle to remove tubing.

9. Inspect flared ends for splits, cracks, pits or excessive out of round which may cause leaks.

10. Blow tubing out with dry compressed air to remove any foreign objects.

27. Power Brake Unit

a. Removal

1. Disconnect hydraulic brake lines from master cylinder, Fig. 5-33. Cap line fittings to prevent dirt from entering brake lines.

2. Disconnect vacuum hose from vacuum check valve on power head.

3. Remove steering column lower cover as described in Section 12, Note 41a.

4. Remove retainer and washer that attach power unit push rod to brake pedal arm.

5. Remove any three of four nuts securing power unit to cowl and loosen fourth nut.

6. Working in engine compartment, free power unit from cowl.

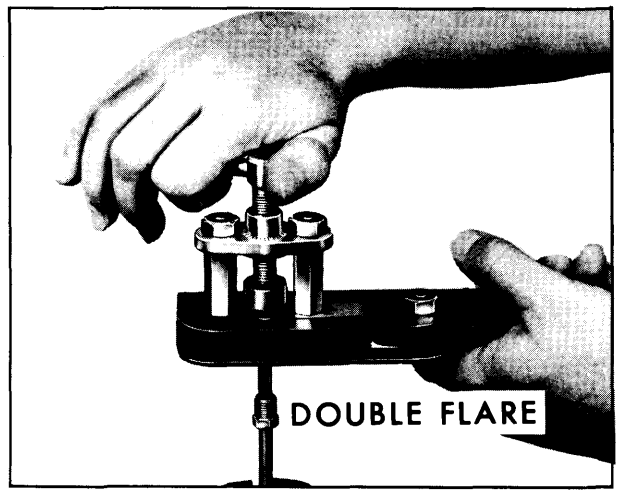


Fig. 5-32 Completing Double Lap Flare

7. Disconnect brake unit push rod from brake pedal arm. Remove spring spacer from brake pedal arm.

8. Remove remaining nut retaining power unit to cowl, and remove power unit gaskets and spacer from engine compartment.

b. Installation

1. Position power unit gaskets and spacer to cowl.

2. Working inside passenger compartment, loosely install four nuts retaining power unit to cowl.

3. Install spring spacer, push rod and washer on brake pedal arm and secure with retainer.

4. Tighten four nuts that hold the power unit to 16 foot-pounds.

See CAUTION page 5-8 prior to Note 6.

5. Install steering column lower cover as described in Section 12, Note 41b.

6. Connect vacuum hose to check valve on power unit.

7. Secure hydraulic brake lines to master cylinder to 20 foot-pounds maximum.

8. Bleed brakes as described in Note 6.

28. Master Cylinder Disassembly, Cleaning, Inspection and Assembly (Fig. 5-34)

a. Disassembly

(NOTE: If trouble has been traced to hydraulic system, master cylinder may be removed from power head without removing power head from car. Area surrounding master cylinder mounting surface must be kept clean.)

1. Disconnect and cap front and rear brake lines if not done previously.

2. Remove two self-locking nuts that hold master cylinder to power head and remove master cylinder.

3. Pry bale type retainers off of reservoir cover, and remove reservoir cover and seal. Drain brake fluid from reservoirs.

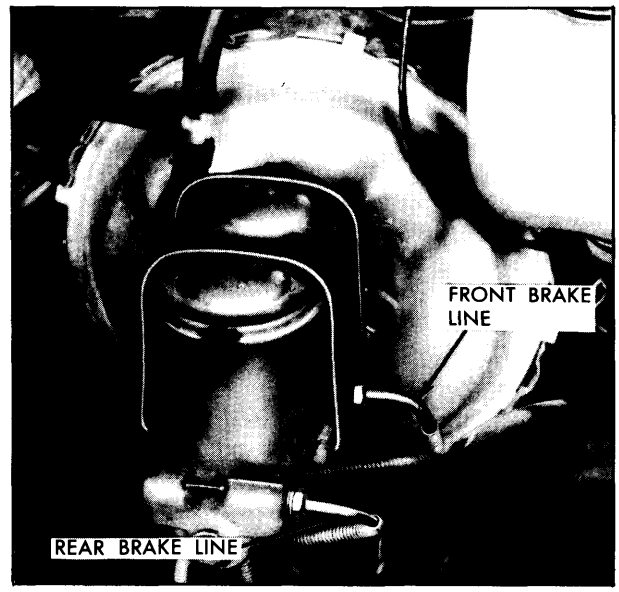


Fig. 5-33 Vacuum Power Brake Unit

BACK TO INDEX

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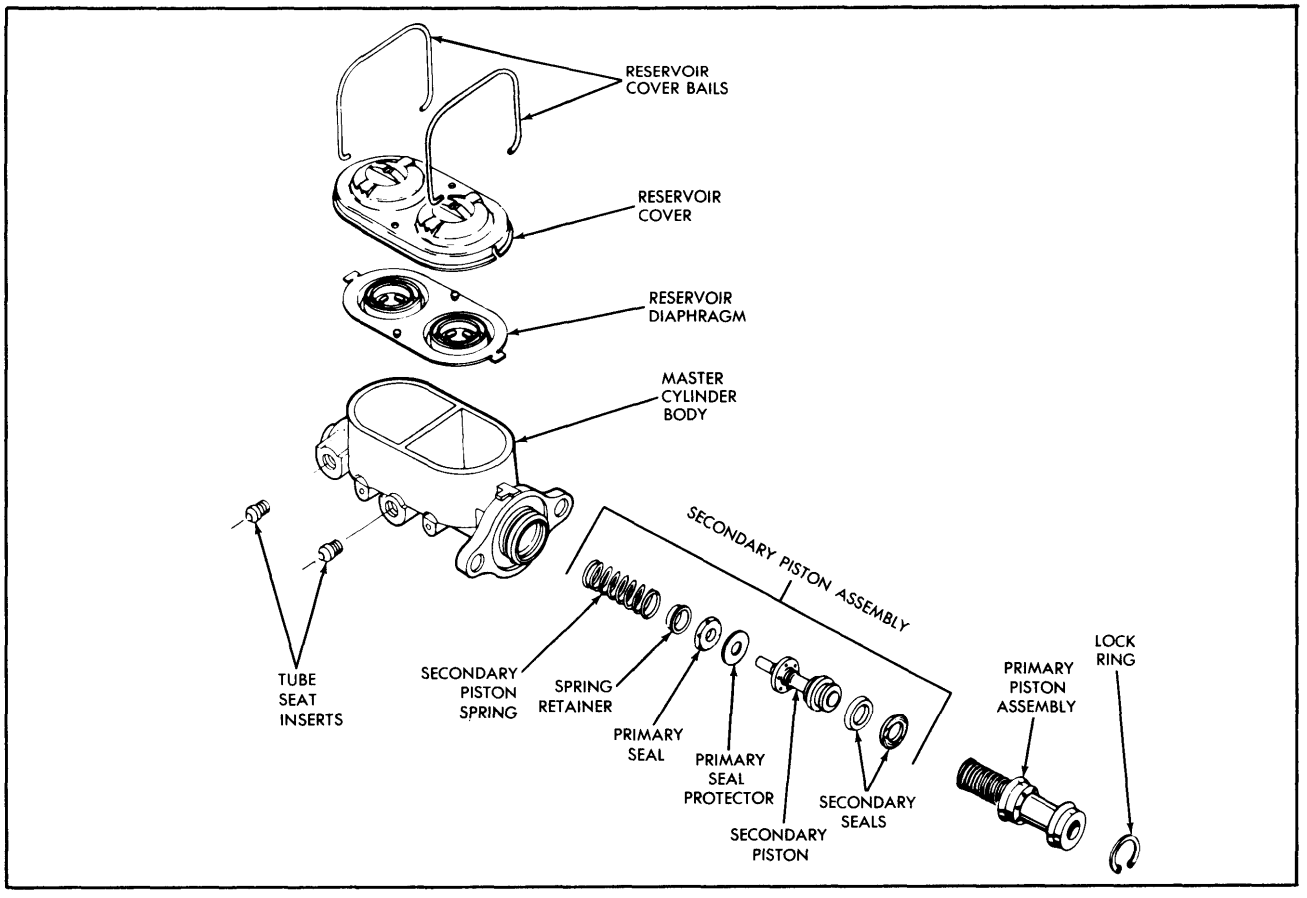


Fig. 5-34 Master Cylinder Disassembled

4. Remove seal from reservoir cover.

5. Remove lock ring from open end of master cylinder and remove rear piston assembly, Fig. 5-34.

6. Firmly rap master cylinder on a block of wood until floating piston drops in bore and remove front (floating) piston assembly, retainer and spring.

CAUTION: Check progress of floating piston dropping in bore to avoid striking piston on wood. If floating piston sticks in bore, blow dry compressed air through front brake outlet hole to force piston out.

7. Place master cylinder in vise with outlet holes up being careful not to damage reservoir seal surface of casting.

8. Remove the primary seal, primary seal protector and secondary seals from the front (floating) piston.

9. Remove piston extension screw from center of floating piston stop and remove floating piston stop and spring from rear piston.

(NOTE: If necessary, grasp the unfinished piston body immediately under flange containing holes with a pair of pliers to remove piston extension screw.)

10. Remove spring retainer, primary seal, primary seal protector and secondary seal from the rear piston.

b. Cleaning and Inspection

1. Inspect master cylinder bore for scoring, pitting or etching. Any of these will require replacement of master cylinder casting.

2. Examine fluid reservoir for foreign matter, and check all passages for restrictions. If there is any suspicion of contamination or evidence of corrosion, completely flush hydraulic system, using clean brake fluid.

(NOTE: A grease like silicone substance may be found inside the brake master cylinder when it is being overhauled. This substance is used by the manufacturer as a lubricant to provide smooth brake actuation. It is a normal condition and need not be cleaned out of the master cylinder before reassembly.)

3. Inspect floating piston for severe scoring, pitting, or distortion. Any of these will require replacement of master cylinder assembly.

4. Thoroughly wash all parts (except the inside of master cylinder) in clean alcohol, including new parts to be used in assembly of master cylinder but do not wash silicone out of master cylinder.

CAUTION: Use of gasoline, kerosene, or any cleaner with even a trace of mineral oil can damage rubber parts.

5. Use air hose to blow out all passages, orifices, and valve holes. Air dry and place cleaned parts on clean paper or lint-free cloth.

6. When overhauling a master cylinder, use all parts furnished in master cylinder repair kit.

c. Assembly

Be sure all parts are clean before assembling master cylinder. Do not let grease or mineral oil come in con-

BACK TO INDEX

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tact with any rubber parts.

1. Lubricate rubber parts with clean brake fluid.
2. Install new secondary seal in center groove of floating piston. Lip of seal should face compensating holes in opposite end of piston.
3. Install new secondary seal in groove at end of floating piston, back-to-back with secondary seal in center groove, Fig. 5-34 so that lip faces toward that end.
4. Install primary seal protector and primary seal over end of floating piston opposite secondary seals. Seal protector seats against flange of piston that contains compensating holes, and flat side of seal seats against protector.
5. Install secondary seal in groove on push rod end of rear piston. Lip of seal should face toward compensating holes in opposite end of piston.
6. Install primary seal protector and primary seal on opposite end of rear piston. Seal protector seats against flange of piston that contains compensating holes, and flat side of seal seats against protector.
7. Position spring retainer on one end of rear piston spring and floating piston stop on other end.
8. Position spring assembly on rear piston with spring retainer seated inside lips of primary seal.
9. Insert piston extension screw in center of floating piston stop.
10. Compress primary piston spring and start piston extension screw in hole in end of piston, release spring and turn down screw. Torque to 7-8 foot-pounds to bottom shoulder on screw against retainer.
11. Position retainer in floating piston spring and position spring assembly on floating piston with retainer seat inside lip of primary seal.

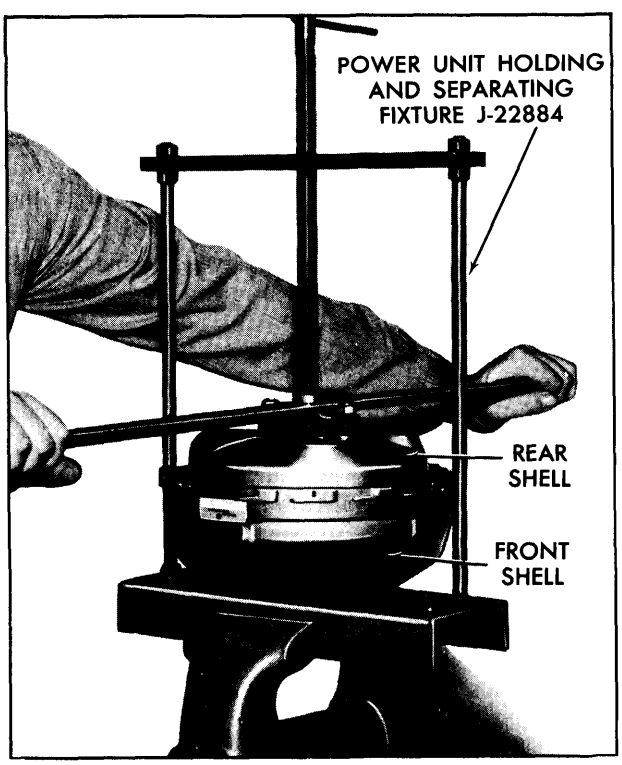


Fig. 5-35 Removing Rear Shell

12. Coat master cylinder bore, primary seal and secondary seals on floating pistion with clean brake fluid.
13. Position master cylinder casting in vise so that open end of bore is down slightly and install floating piston assembly in bore, spring end first, until assembly bottoms in bore.
14. Reposition master cylinder in vise so that open end of bore is up.
15. Coat primary and secondary seals on rear piston assembly with clean brake fluid and insert assembly into master cylinder bore, spring end first.
16. Pressing downward on rear piston, install lock ring in groove in master cylinder piston.
17. Install new reservoir seal on reservoir cover, place cover on master cylinder, retaining with bale-type retainers.
18. Install master cylinder on power head, torquing nuts to 20 foot-pounds maximum torque.
19. Install front and rear brake lines, if power head is on car, tightening lines to 15 foot-pounds and bleed brakes as described in Note 6.

29. Vacuum Power Head Disassembly, Cleaning, Inspection and Assembly

a. Disassembly

(NOTE: Scribe mark on top center of front and rear housings in line with master cylinder reservoir cover to facilitate reassembly.)

1. Remove master cylinder reservoir cover retainers, reservoir cover and diaphragm, and empty brake fluid from reservoirs.
2. Remove two locknuts which hold master cylinder to front housing, and remove master cylinder from its mounting studs. Remove front housing seal from front shell.

(NOTE: If Separating Fixture, J-22884, is not available, use Separator, J-9504. Do not remove master cylinder at this time if J-9504 is to be used.)

3. Secure Power Unit Shell Holding and Separating Fixture, J-22884, and power head, Fig. 5-35. Studs on rear shell engage base of fixture and studs on front shell engage bar of tool with bar bearing against front shell. Secure front shell to bar with two master cylinder lock nuts.
4. Rotate bar counterclockwise and unlock shells.
5. Back off on hold down clamp sufficiently to remove front shell, return spring, retaining plate and piston rod retainer, Fig. 5-36 and 5-37.

WARNING: BE CAREFUL WHEN SEPARATING DIAPHRAGMS THAT RETURN SPRING DOES NOT FLY OUT AS INJURY MAY OCCUR.

6. Remove vacuum check valve and grommet from front shell.
7. Remove assembly from holding fixture and remove J-22884 from vise.

BACK TO INDEX

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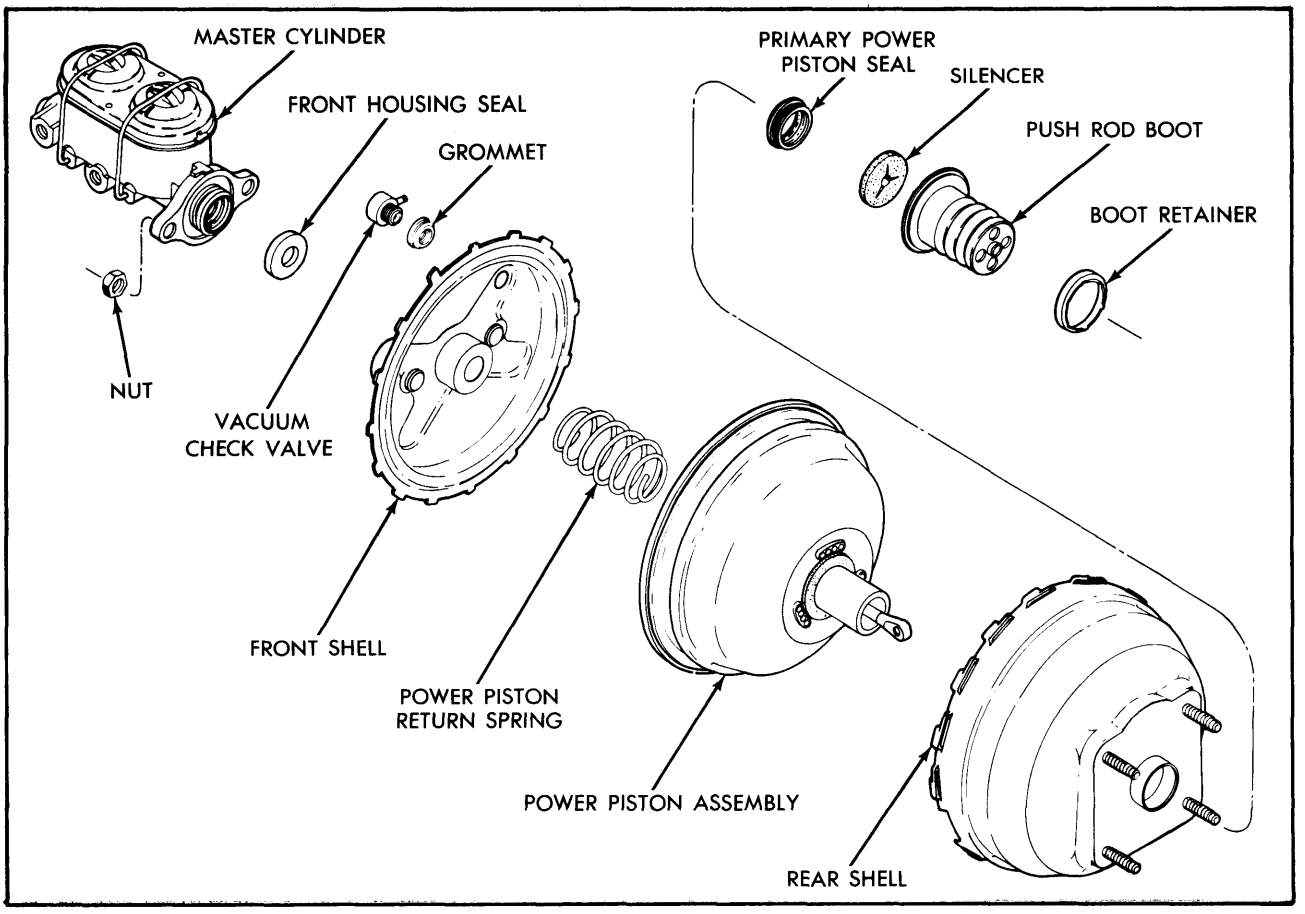


Fig. 5-36 Vacuum Power Head Disassembled

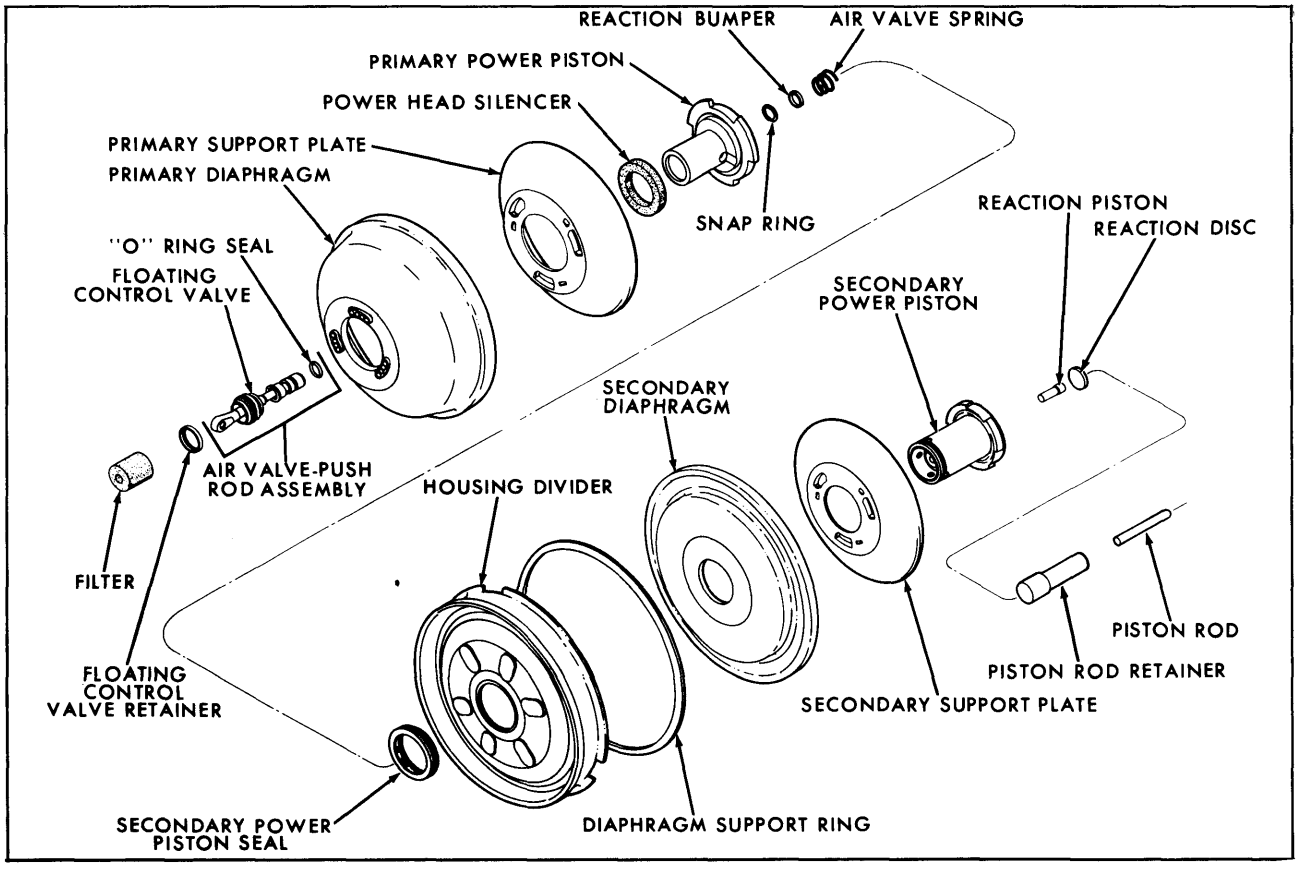


Fig. 5-37 Power Piston Disassembled

BACK TO INDEX

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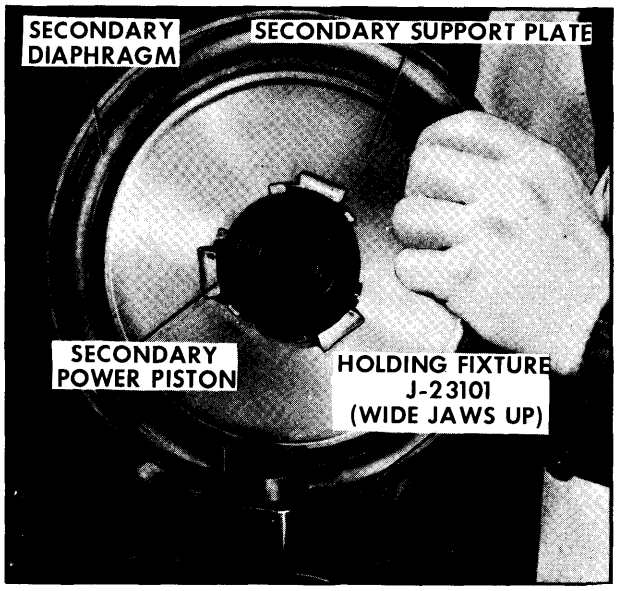


Fig. 5-38 Positioning Secondary Power Piston

8. Remove dust boot retainer and boot from rear housing and push rod. Remove felt silencer from inside the boot.

9. Remove power piston assembly from rear shell and remove primary power piston seal from center opening of rear shell.

10. Lift bead on outside diameter of secondary diaphragm and remove diaphragm support ring, Fig. 5-37.

11. Mount Holding Fixture, J-23101, in a vise with wide jaws up. Position secondary power piston so that two radial slots in piston fit over jaws of tool, Fig. 5-38.

12. Fold back primary diaphragm from outside diameter of primary support plate. Grip edge of support plate and rotate counterclockwise to unscrew primary piston from secondary power piston, Fig. 5-39.

(NOTE: It is possible that primary support plate will unlock from primary piston before primary piston unscrews from secondary piston. If this happens, continue to turn primary support plate counterclockwise. Tabs ("stops") on primary support plate will temporarily lock primary support plate to primary power piston and permit continued counterclockwise rotation to unscrew primary power piston from secondary power piston.)

13. Remove air valve spring from secondary power piston or end of air valve.

14. Remove housing divider from secondary power piston. Remove secondary power piston seal from housing divider.

15. Secondary power piston should still be positioned on Tool J-23101. Fold back secondary diaphragm from O.D. of secondary support plate. Grip edges of support plate and rotate clockwise to unlock secondary support plate from secondary power piston, Fig. 5-40.

16. Remove secondary diaphragm and support plate and separate.

17. Remove reaction piston and reaction disc from center of secondary power piston by holding it in hand

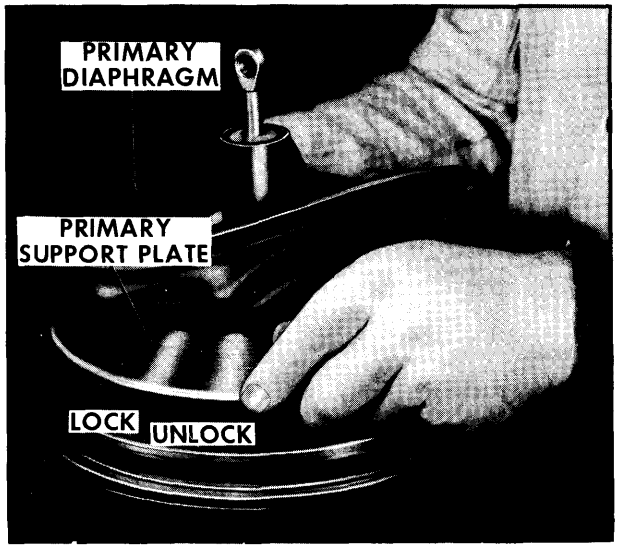


Fig. 5-39 Loosening Power Pistons

and pushing down on end of reaction piston with a small object, such as a pencil, wooden dowel or metal rod, Fig. 5-41.

18. Mount Tool J-23101 in vise with small jaws up. Position primary power piston so two radial slots in piston fit over jaws of tool, Fig. 5-42.

19. Fold back primary diaphragm from support plate. Grip edge of support plate and rotate in a counterclockwise direction to unlock primary support plate from primary power piston, Fig. 5-43.

20. Remove primary diaphragm from primary support plate.

21. Remove air filter from tubular section of primary power piston, Fig. 5-37.

22. Remove power head silencer from neck of power piston tube.

23. Remove rubber reaction bumper from end of air valve.

24. Clamp eyelet end of air valve push rod in side of vise and using Snap Ring Pliers, J-4880 remove snap ring from air valve, Fig. 5-44.

25. Remove air valve-push rod assembly from tube end of primary power piston by pulling on primary power piston. A considerable force will be required.

Removal of air valve push rod assembly will disassemble control valve retainer.

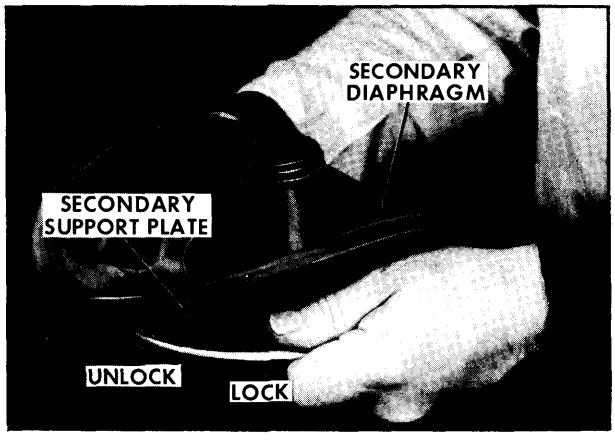


Fig. 5-40 Removing Secondary Diaphragm

BACK TO INDEX

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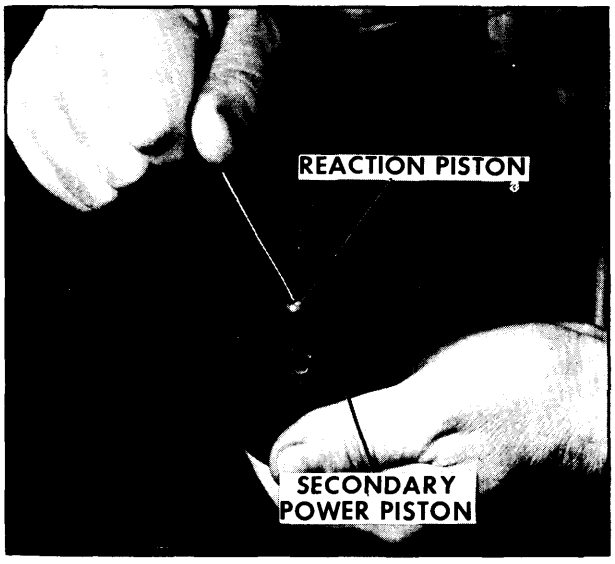


Fig. 5-41 Removing Reaction Piston

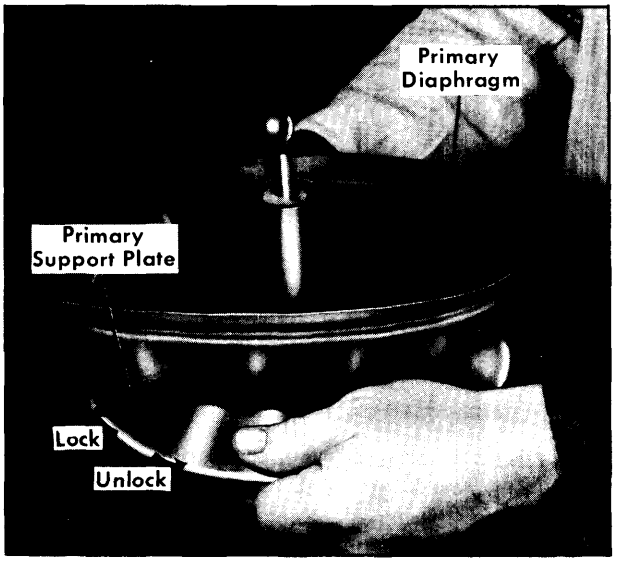


Fig. 5-43 Removing Primary Diaphragm

26. Remove "O" ring seal from air valve.

Air valve push rod assembly is serviced as a complete assembly, since floating control valve cannot be removed over end of push rod.

b. Cleaning and Inspection

1. Thoroughly wash all parts in clean alcohol.

CAUTION: Use of gasoline, kerosene, or any cleaner with even a trace of mineral oil can damage rubber parts.

2. Use air hose to blow out all passages, orifices, and valve holes. Air dry and place cleaned parts on clean paper or lint-free cloth.
3. If any rust is found inside front or rear shell, polish clean with crocus cloth or fine emery paper, washing clean afterwards.
4. Inspect front and rear shells for scratches, scores, pits, dents or other damage affecting rolling or sealing of diaphragm or other seals. Small imperfections may be smoothed out with fine crocus cloth.
5. Inspect all original parts, not being replaced by repair kit, for damage, distortion or excessive wear and chips, and replace as necessary.
6. Use all parts furnished in power head repair kit.

c. Assembly

1. Lubricate "O" ring seal, Fig. 5-37 with silicone lubricant and place on air valve.
2. Wipe a thin film of silicone lubricant on large and small O.D. of floating control valve.
3. If floating control valve needs replacement, it will be necessary to replace complete air valve push rod assembly, since floating control valve is a component part of this assembly and cannot be disassembled from push rod, Fig. 5-45.
4. Place air valve end of air valve push rod assembly into tube of primary power piston. Manually press air

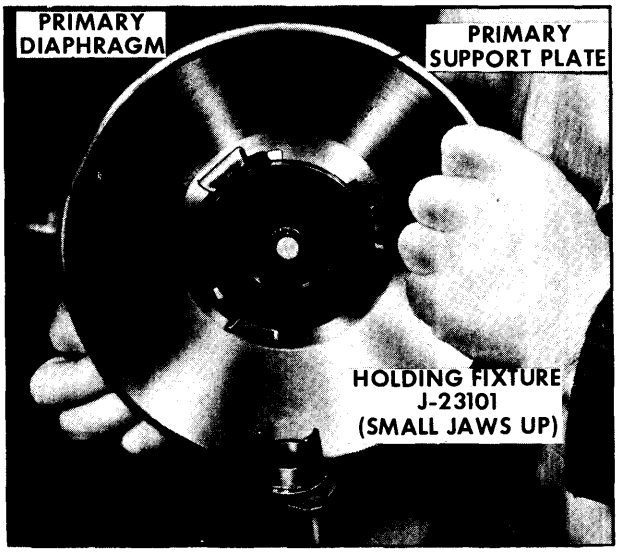


Fig. 5-42 Positioning Primary Power Piston

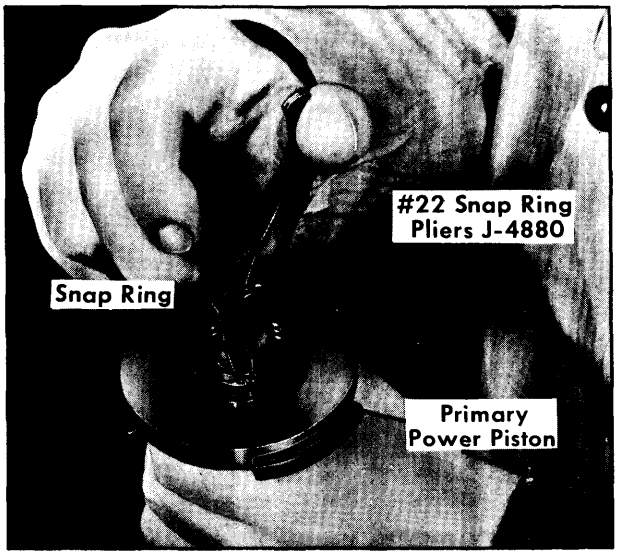


Fig. 5-44 Removing Snap Ring From Air Valve

BACK TO INDEX

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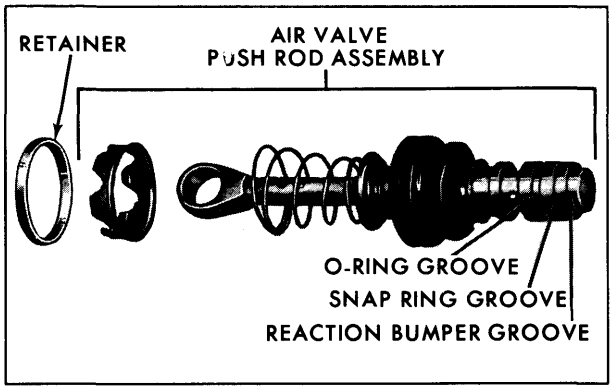


Fig. 5-45 Floating Control Valve

valve push rod assembly so that floating control valve bottoms on tube section of primary power piston.

5. Place floating control valve retainer (Fig. 5-44) on Control Valve Retainer Installer, J-23175. Place over push rod so that closed side of retainer seats on floating control valve. With Installer, J-23175, manually press retainer and floating control valve assembly to seat in primary power piston tube, Fig. 5-46.

6. The filter element can now be stretched over push rod eye and pressed into primary power piston tube, Fig. 5-37.

7. Using Snap Ring Pliers, J-4880, place snap ring in its air valve groove, Fig. 5-44.

(NOTE: If snap ring is installed in O-ring groove, power pistons will not thread together all the way and threads may be damaged.)

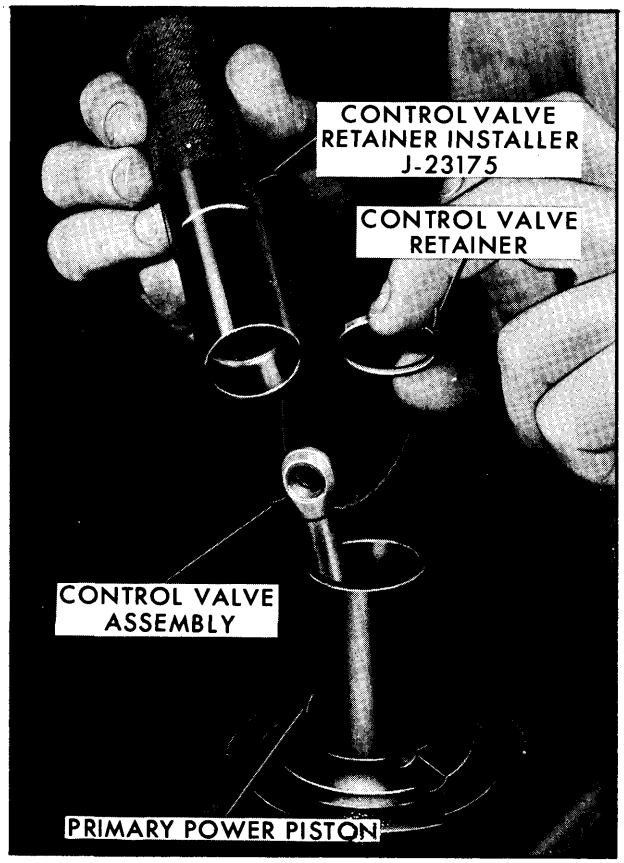


Fig. 5-46 Installing Retainer Ring

8. Position rubber reaction bumper on end of air valve.

9. Apply a light film of silicone lubricant to O.D. of rubber reaction disc. Place disc in small cavity of the secondary power piston and push disc down to seat on reaction piston.

10. Assemble primary diaphragm to primary support plate from side of plate opposite locking tangs, Fig. 5-37. Press raised flange on I.D. of diaphragm through center hole of support plate. Be sure edge of support plate center hole fits groove in raised flange of diaphragm. Lubricate diaphragm I.D. and raised surface of flange that fits into a groove in the primary power piston with light coat of silicone lubricant.

11. Mount Holding Fixture, J-23101, in vise, small jaws up. Position primary power piston so two radial slots in piston fit over jaws of tool, Fig. 5-42.

12. Fold primary diaphragm away from O.D. of the primary support plate.

13. Holding edges of the support plate, with the locking tangs down, place primary support plate and diaphragm assembly over tube of primary power piston. Flange on the I.D. of primary diaphragm will fit groove in the primary power piston.

14. Grip edges of primary support plate, press down, and rotate clockwise until tabs on primary power piston contact stops on support plate, Fig. 5-43.

15. Place power head silencer on tube of primary power piston so holes at the base of tube are covered.

16. Apply a very light film of silicone lubricant to O.D. of primary power piston tube.

17. Remove primary piston assembly from Tool J-23101 and lay it aside.

18. Assemble secondary diaphragm to secondary support plate from side of support plate opposite



Fig. 5-47 Installing Housing Divider

BACK TO INDEX

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locking tangs, Fig. 5-37. Press raised flange on I.D. of diaphragm through center hole of support plate. Be sure edge of support plate center hole fits groove in the raised flange of diaphragm. Apply thin coat of silicone lubricant to I.D. of secondary diaphragm and raised surface of flange (that fits into a groove in the secondary power piston).

19. Mount Tool J-23101 in vise with large jaws up. Position secondary power piston so curved slots in piston fit over jaws of tool, Fig. 5-38. Apply light coat of silicone lubricant to tube of secondary power piston.

20. Fold secondary diaphragm away from O.D. of secondary support plate.

21. Holding edges of the support plate, with locking tangs down, place secondary diaphragm and support plate assembly over tube of secondary power piston. Flange on I.D. of secondary diaphragm will fit secondary piston groove.

22. Grip edges of secondary support plate, press down, and rotate counterclockwise until tabs on secondary power piston contact stops on support plate, Fig. 5-39. Fold secondary diaphragm back into position on secondary support plate. Leave secondary power piston assembly on Tool J-23101 in vise.

23. Apply light coat of talcum powder or silicone lubricant to bead on O.D. of secondary diaphragm. This will facilitate assembly of front and rear housings.

24. Place secondary diaphragm support ring on the secondary power piston assembly so it rests on edge of diaphragm.

25. Hold the housing divider so the six impressions on middle of divider stick up. Install seal so part number can be read from this side.

26. Lubricate I.D. of secondary seal with silicone lubricant.

27. Position Secondary Seal Protector Tool, J-23188 on threaded end of secondary power piston, Fig. 5-47.

28. Hold the housing divider so the six impressions on middle of divider stick up. Press divider down over tool and onto secondary power piston tube where it will rest against the diaphragm support ring. Remove Seal Protector, J-23188, from secondary power piston; however, do not remove secondary power piston subassembly from Holding Fixture, J-23101.

29. Pick up primary power piston assembly and position small end of air valve return spring on air valve so it contacts air valve retaining ring.

30. Fold primary diaphragm away from O.D. of primary support plate.

31. Position primary power piston on tubular portion of secondary power piston, making sure small end of air valve return spring seats on air valve snap ring.

32. Grip edge of primary support plate, press down, and start threads on secondary power piston into threaded portion of primary power piston by rotating clockwise, Fig. 5-39.

33. Continue to tighten primary power piston until it is securely attached to secondary power piston.

34. Fold primary diaphragm back into position on primary support plate and pull diaphragm O.D. over formed lip of housing divider. Check to be sure bead on diaphragm is seated evenly around complete circumference.

35. Remove assembly from tool J-23101. Wipe a thin film of silicone lubricant on O.D. of piston rod retainer. Insert master cylinder piston rod retainer into secondary power piston cavity so flat end bottoms against rubber reaction disc in bottom of cavity.

36. Place primary power piston seal in rear housing center hole so formed flange of housing center hole fits groove of primary power piston seal. The part number of seal should show on inside of shell.

37. Coat I.D. of primary power piston seal with thin film of silicone lubricant.

38. Mount Power Unit Holding and Separating Fixture, J-22884, in vise and position rear shell on tool so studs fit holes provided in tool.

39. Position power piston return spring over front shell.

40. Assemble power piston to rear shell by pressing primary power piston tube through rear housing seal. Press down until housing divider seats in the rear shell and primary power piston bottoms against shell.

41. Place piston rod retaining plate on end of power piston.

42. Install vacuum check valve grommet in front shell with large diameter outside.

43. Install vacuum check valve.

44. Hold front shell assembly (with mounting studs up) over rear shell. Position front shell so that when tangs on edge of front shell are locked in slots on edge of rear shell, scribe marks on top of shells will be in line.

45. Lower front shell assembly onto rear shell by tightening hold down clamp. Check to be sure piston rod retainer goes through center of retaining plate on power piston return spring. Retaining plate and power piston spring must seat in depression in face of secondary power piston. Check to be sure bead on O.D. of secondary diaphragm is positioned between edges of shells.

46. Continue to tighten clamp on front shell and fit tangs, in appropriate slots, on rear shell.

47. Rotate bar clockwise into locked position and remove power head from Holding Fixture, J-22884.

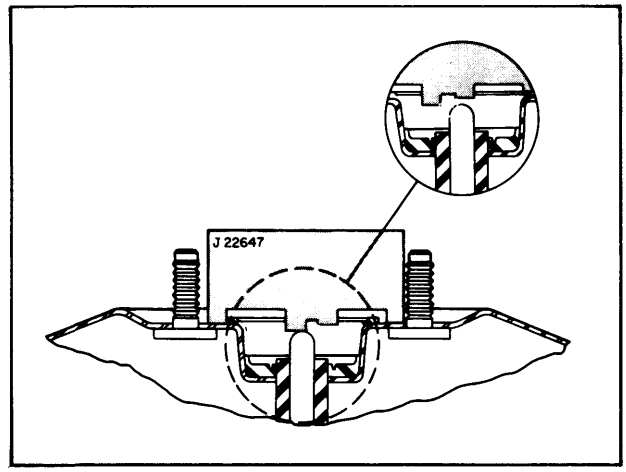


Fig. 5-48 Gaging Push Rod

BACK TO INDEX

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48. Place silencer in closed end of power head boot. Stretch boot over push rod and over flange in center of rear housing and install boot retainer.

49. Place power head assembly in vise with front shell facing up. Insert master cylinder piston rod, flat end first, into piston rod retainer.

50. Press down on master cylinder piston rod to be sure it is properly seated.

(NOTE: Remove front housing seal to assure that no vacuum is in power head while gaging.)

51. Place Gage, J-22647, over piston rod in a position which will allow gage to be slipped to left or right without contacting studs. (Fig. 5-48)

The center section of gage has two levels. The piston rod should always contact the long section (low level) of gage. The piston rod should never contact the short section (high level) of gage, Fig. 5-48. Move gage from side to side to check piston rod height.

Any variation beyond these two limits must be compensated for by obtaining an adjustable piston rod from your servicing Parts Distribution Center and adjusting self-locking screw to meet gaging specifications.

52. Wipe a thin film of silicone lubricant on the I.D. of front housing seal and position seal in housing depression.

53. Install master cylinder assembly on front housing, positioning cylinder on mounting studs so top of master cylinder reservoir is toward scribe marks on housing. Assemble locknuts on studs and torque to 20 foot-pounds.

BACK TO INDEX

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SPECIFICATIONS

Item		All Series Except Eldorado
Swept Braking Area (in square inches)		
Front		241
Rear		189
Lining Area (in square inches)		
Front		42
Rear		117
Wheel Cylinder Bore		
Front		2-15/16"
Rear – Except Commercial		15/16"
Rear – Commercial		1"
Drums (inside diameter)		12.00"
Remachined Drum Diameter (maximum)		12.060"
Worn Drum Diameter (maximum)		12.090"
Variations of Inside Drum Diameter (maximum)		.0015"
Run-Out of Inside Drum Diameter (maximum)		.005"
Disc Thickness – minimum – Refinished		1.220"
– minimum – Worn		1.215"
Clearance Between Secondary Linings and Drums		.010" – .030"
Lateral Run-Out of Disc		.005"
Flatness and Parallelism Between Frictional Surfaces of Disc		.0005"
Lining Size (length, width, thickness in inches)		
Front	Inner Shoe	5.4 x 1.93 x .43
	Outer Shoe	5.4 x 1.93 x .41
Rear Primary		11.00 x 2.50 x .24
Rear Secondary		12.36 x 2.50 x .26
Lining to Shoe Attachment Method Rear		Rivets
Front		Steel Eyelet
Brake Combination Valve		
Front Brake Cut-in Pressure		130 psi
Front Brake Blend Pressure		650 psi
Rear Brake Proportioning Pressure – (Except Limousine and Commercial)		41% above 470 psi
Failure Warning Differential Pressure		100-300 psi

BACK TO INDEX

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TORQUE SPECIFICATIONS

Material Number	Application	Size	Foot-Pounds
Special	Pipe Nut to Master Cylinder	1/2 –20 or 9/16–18	25 Max.
Special	All Other Brake Pipe Nuts	3/8 –24, 7/16–24, 1/2 –20	20 Max.
260M	Parking Brake Cable Clamps (at Backing Plate)	5/16–24	11
Special	**Brake Hose to Caliper	7/16–20	30 Max.
300M	**Brake Backing Plate to Rear Axle Housing	7/16–20	40 Max.
284M	**Brake Unit to Cowl	3/8 –16	13
286M	Brake Pedal Pivot Bolt	7/16–20	13
286M	Master Cylinder to Vacuum Power Head	3/8 –24	20
Special	**Caliper to Steering Knuckle Bolt	Special	30
Special	Piston Extension Screw	Special	90*
286M	Wheel Mounting Nuts	1/2 –20	100
Special	Bleeder Screw	Special	*Inch-Pounds 90
(NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings and steel classifications.)			

***CAUTION: This fastener is is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.*

BACK TO INDEX

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THEORY OF OPERATION

Trackmaster is an optional accessory that can be installed on all cars except Eldorados and the commercial chassis.

Purpose of System

Wheel or brake lock-up occurs when the brake is applied so tightly that the wheel is held from turning and skids on the road surface. Since a tire will skid about as easily in one direction as another, a car with locked rear wheels may yaw or swerve, sending the rear end out of control. In severe cases this yaw may result in "spin-out".

Skidding may also increase the distance in which the car may be stopped as friction developed between tire and road surface may be less when sliding than when rolling, especially on a wet surface.

To improve maximum braking characteristics, the Track Master System is available as optional equipment. The primary purposes of the system during a panic stop or other hard application of brakes are: (1) maintain lateral stability of the car; (2) provide near maximum controlled braking effort to decrease stopping distance, on most road surfaces; (3) prevent flat spots on tires.

Controlling Rear Wheel Lock

All of these objectives are obtained by keeping the rear wheels rolling, with the brakes applied as tightly as possible, without actually locking the rear wheels. In practice, improvement in lateral stability is significant under most driving conditions, while decrease in stopping distance is most effective on wet pavements.

Basic Operation

Most car stops are at low rates of deceleration, with only a moderate application of force to the brakes, and the Track Master System is inoperative. However, the system is energized whenever the ignition is on, and it stands ready to function whenever a rear wheel is about to lock – whether as a result of an emergency stop with good tires on dry concrete or just a slow stop with worn tires on a wet or icy road.

Skid control starts with a speed indication taken from a magnetic pick-up device known as the sensor. The sensor produces an electrical frequency that is proportional to wheel speed. This frequency is monitored by the controller.

When a wheel is not locking during brake application, the wheel will gradually decelerate. However, when a wheel has started to lock, it will decelerate abruptly at a rate much faster then the car's deceleration.

When the controller determines that the frequency changes too rapidly and the car is thereby approaching a skid condition, the controller sends an electrical signal to the modulator solenoid.

The modulator seals hydraulic pressure from the brake master cylinder and then increases the hydraulic fluid volume from the modulator to the rear wheel cylinders. This increased volume results in decreased hydraulic pressure and partial brake release.

With the rear brakes partially released, the wheels accelerate and, as car speed is approached, the controller senses the condition and de-energizes the modulator.

This action positions the modulator to increase brake pressure to the rear wheel cylinders until a locking condition is again sensed. The entire cycle of partial brake release and re-application occurs in about 1/3 of a second. During a stop where brake pressure is sufficient to cause lock-up, the cycling will continue until the car is slowed to approximately five miles per hour, or until the brakes are released by the driver.

Control of Circuits

Figure 5-49 and 5-50 illustrate the total Track Master System control circuits.

a. Hydraulic Control Circuit

In addition to the normal brake system components (dual master cylinder, brake combination valve, front calipers, rear wheel cylinders, connecting brake lines), the hydraulic control circuit also includes the hydraulic check valve. This valve, which is an integral part of the modulator assembly, is connected between the brake combination valve and rear brake wheel cylinders.

b. Vacuum Control Circuit

This vacuum control circuit includes the vacuum hose connection from the engine manifold, vacuum check valve, valve section of the solenoid valve, and actuator section of the modulator assembly. The vacuum control circuit provides the power necessary to operate the modulator.

c. Electrical Control Circuit

This electrical control circuit includes the controller, solenoid section of the solenoid valve, speed sensor and modulator travel switch. Electrical power is supplied to the Track Master System when the ignition switch is turned to all positions except "OFF" and "Accessory".

Each time the ignition switch is turned on, a momentary ground is created in the transistorized circuitry of the controller, energizing the modulator solenoid. An audible sound accompanies this exercising cycle, indicating operation.

30. Major System Components

a. Speed Sensor

The speed sensor mounts in the transmission in place of the speedometer driven gear assembly. Both the driven gear and flexible shaft coupling are integral parts of the sensor. Since the rear wheels are connected through the differential and transmission, the one transmission speed sensor produces an effective speed signal.

BACK TO INDEX

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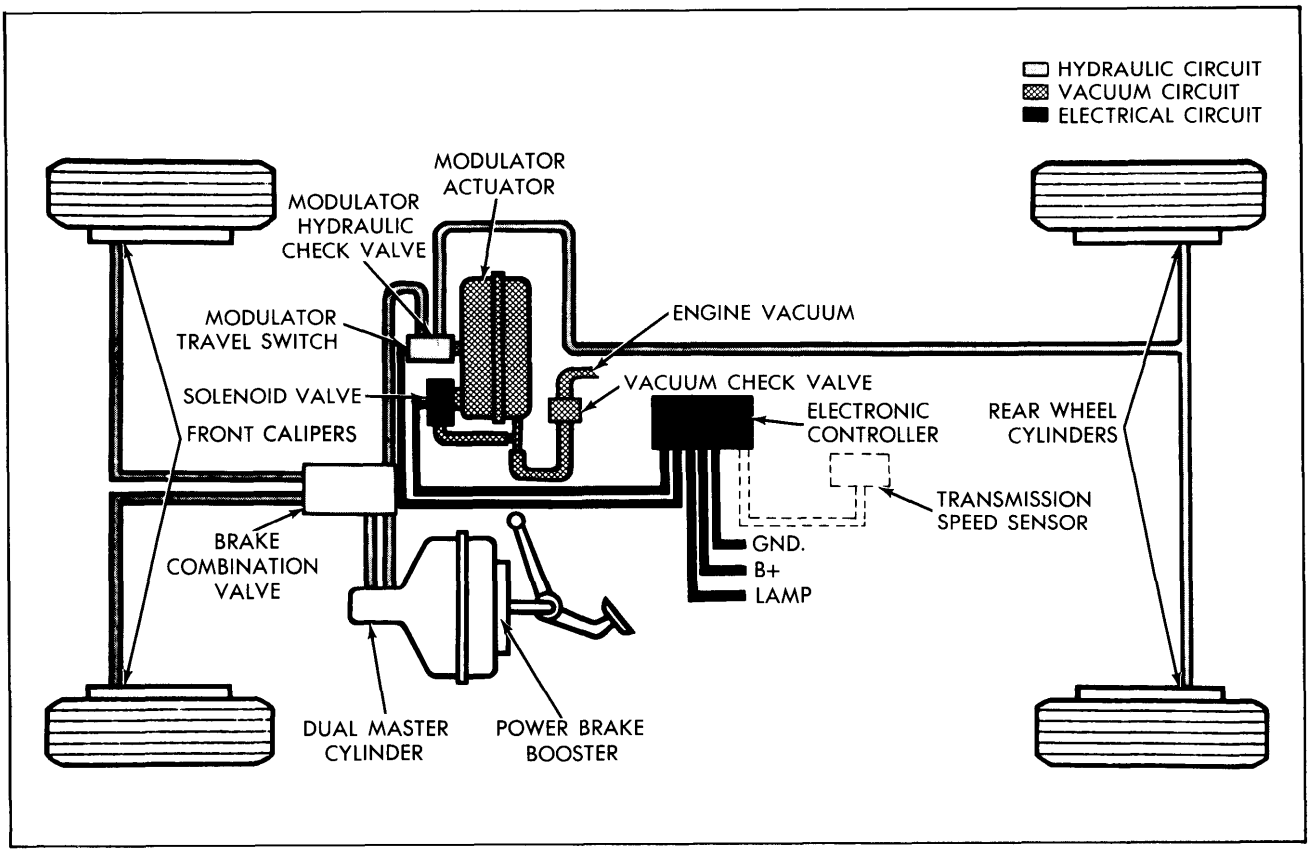


Fig. 5-49 Control Circuits—Except Limousines

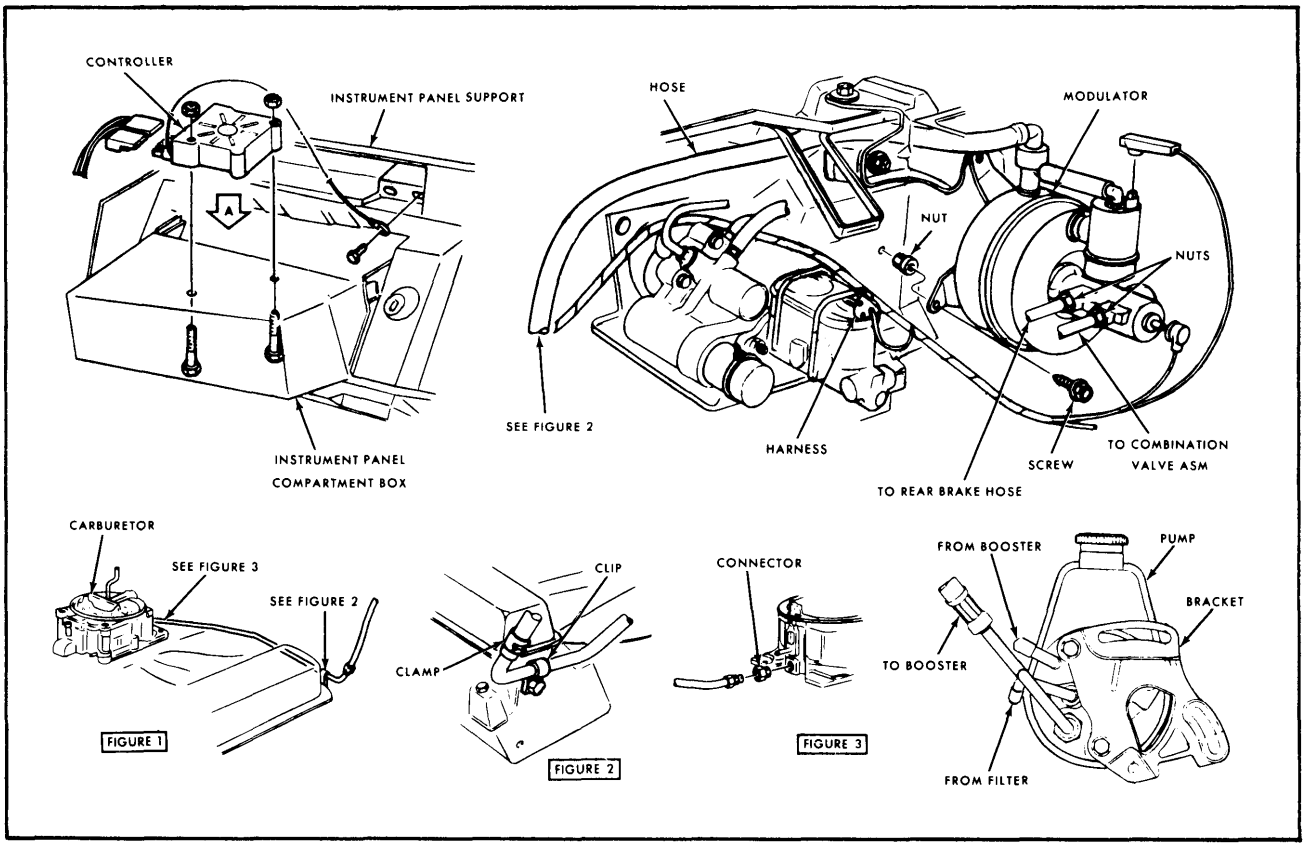


Fig. 5-50 Control Circuits—Limousines Only

BACK TO INDEX

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b. Controller

The controller is the electronic computer in the Track Master System.

The controller receives and continuously monitors the input speed signals from the transmission speed sensor. Its basic functions are to determine from the input speed signal when rear wheel lock-up is impending, to provide an electrical output which automatically partially releases the rear brakes, to determine when the impending rear wheel lock-up situation ceases to exist, and again apply the rear brakes.

c. Modulator

The modulator with the integral solenoid valve is mounted on the left side of the cowl. Its basic function is to control or pulse the hydraulic pressure to the rear brakes during maximum braking stops, similar to pumping the brake pedal with your foot.

Included as parts of the overall modulator assembly are a vacuum check valve and solenoid valve. Electrical connections are made to the solenoid valve and travel switch, engine vacuum is connected to the vacuum check valve, and hydraulic connections are made to the rear brakes (outlet port) and brake combination valve (inlet port).

d. Solenoid Valve

The solenoid valve is a three-way vacuum valve which is operated by the electro-magnetic action of a solenoid. It is mounted through a grommet as an integral part of the modulator. Sensing that rear wheel lock-up is imminent, the controller sends an electrical signal to the solenoid valve. Its basic function is to convert this electrical signal into an air pressure signal which is used by the modulator.

The resulting action of the modulator is to release the rear brakes. During a maximum braking stop, the solenoid valve will continue to cycle, alternately supplying air or vacuum to the modulator, until the vehicle speed is less than five miles per hour or until the brakes are released by the driver.

e. Brake System Warning Light

The brake system warning light, located in the instrument panel, normally indicates that the brake system has sustained a loss of hydraulic pressure to either the front or rear brakes. The bulb and circuit are checked with the ignition switch in the "START" position, where the "BRAKES" light should be illuminated.

For vehicles equipped with the Track Master option, the brake system warning light also operates in conjunction with the modulator travel switch and special circuitry in the controller to provide a visual indication to the driver in the event of most Track Master System malfunctions. When the travel switch is open more than approximately four seconds (except during a skid controlled stop), the controller turns the tell-tale light on. An exception to this is an open in the 4 amp feed circuit from the ignition switch, which is indicated without the four second delay. When a malfunction is detected, the warning light is illuminated and remains illuminated until the ignition switch is turned off. Any malfunction indication requires immediate inspection of the warning system, the hydraulic system, or Track Master System.

In the event of many types of malfunctions, the rear brake operation automatically reverts to a standard system; i.e., normal operation without the Track Master System option. For certain malfunctions, the restoration of standard brakes is accomplished by a special controller circuit which prevents the generation of an output brake release signal whenever a malfunction indication signal exists in the brake system warning light circuit.

f. Electrical Harness

The Track Master wiring harness consists of a body harness running from the transmission sensor to the controller; and a controller and modulator harness, running from the controller to the ignition circuit and modulator.

The solenoid cable is unique in that it has a single conductor with a braided copper shield and insulating jacket. Contrary to usual practice, the shield is not at ground potential, but is at battery potential. This has been done so that if the solenoid cable is shorted, the control system fuse will blow and the brake system will function in a standard manner. If the system were not designed to blow the fuse, a short in the ground side of the solenoid circuit (light green wire) would keep the rear brakes continuously released.

BACK TO INDEX

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TRACK MASTER DIAGNOSIS CHART

CONDITION	CORRECTION
1. PEDAL "PULSES" OR "BOUNCES" DURING LIGHT BRAKE APPLY STOPS AND CAUSES "JERKY" BRAKING. 2. TRACK MASTER SYSTEM "FALSE CYCLES" DURING NORMAL DRIVING. 3. "RATTLE" OR "CLICKING" IN RIGHT SIDE OF COWL DURING NORMAL DRIVING.	A. CHECK FOR LOOSE SPEEDO DRIVE GEAR ON TRANSMISSION OUTPUT SHAFT, EXCESSIVE SIDE-TO-SIDE CLEARANCE, AND BINDING DURING ROTATION OF SENSOR DRIVE SHAFT. B. IF VEHICLE HAS MOBILE TRANSMITTING EQUIPMENT, CHECK FOR TRACK MASTER SYSTEM INTERFERENCE DURING TRANSMITTER OPERATION. C. CHECK FOR LOOSE OR BROKEN CONTROLLER GROUND WIRE (BLACK). D. FOLLOW PROCEDURE ON PAGE 5-43.
4. BRAKE LIGHT COMES "ON" IMMEDIATELY WHEN IGNITION IS TURNED TO "ON" POSITION WITHOUT APPLYING BRAKES.	1. FOLLOW PROCEDURE ON PAGE 5-41.
5. BRAKE LIGHT COMES ON 2-6 SECONDS AFTER IGNITION IS TURNED TO "ON" POSITION WITHOUT APPLYING BRAKES.	FOLLOW PROCEDURE ON PAGE 5-43.
6. LIGHT COMES "ON" IMMEDIATELY WHEN BRAKES ARE APPLIED AND REMAINS "ON" WHEN BRAKES ARE RELEASED (IGNITION "ON").	LIGHT IS BEING TURNED "ON" BY PRESSURE DIFFERENTIAL SWITCH (LOW PRESSURE IN FRONT OR REAR SYSTEM) – REPAIR AS NECESSARY – NOT A TRACK MASTER SYSTEM PROBLEM.
7. LIGHT COMES ON 2-4 SECONDS AFTER BRAKES ARE APPLIED AND REMAINS "ON" (IGNITION "ON").	FOLLOW PROCEDURE ON PAGE 5-42.
8. LIGHT COMES "ON" IMMEDIATELY WHEN BRAKES ARE APPLIED AND GOES "OFF" WHEN BRAKES ARE RELEASED (IGNITION "ON").	LIGHT IS BEING TURNED "ON" BY PRESSURE DIFFERENTIAL SWITCH. (LOW PRESSURE IN FRONT OR REAR SYSTEM) – REPAIR AS NECESSARY – NOT A TRACK MASTER SYSTEM PROBLEM.
9. REAR WHEELS LOCK UP DURING STOPS BELOW 10 MPH.	NORMAL PERFORMANCE – TRACK MASTER DOES NOT PREVENT LOCK UP ON STOPS BELOW 10 MPH.
10. SINGLE "THUMP" OR "CLICK" IN LEFT SIDE OF COWL WHEN IGNITION IS TURNED TO "ON" POSITION.	NORMAL PERFORMANCE – SYSTEM EXERCISE CYCLE CAUSE A PULSED RELEASE AT STARTUP.
11. EXTREMELY ROUGH AND JERKY TRACK MASTER PERFORMANCE.	A. CHECK REAR SHOCKS AND SUSPENSION. B. CHECK FOR LOW ENGINE VACUUM OR RESTRICTIONS IN TRACK MASTER VACUUM SUPPLY LINES OR AT SOLENOID AIR INTAKE. C. CHECK FOR LOOSE OR BROKEN CONTROLLER GROUND WIRE (BLACK/WHITE). REPAIR AS REQUIRED.

BACK TO INDEX

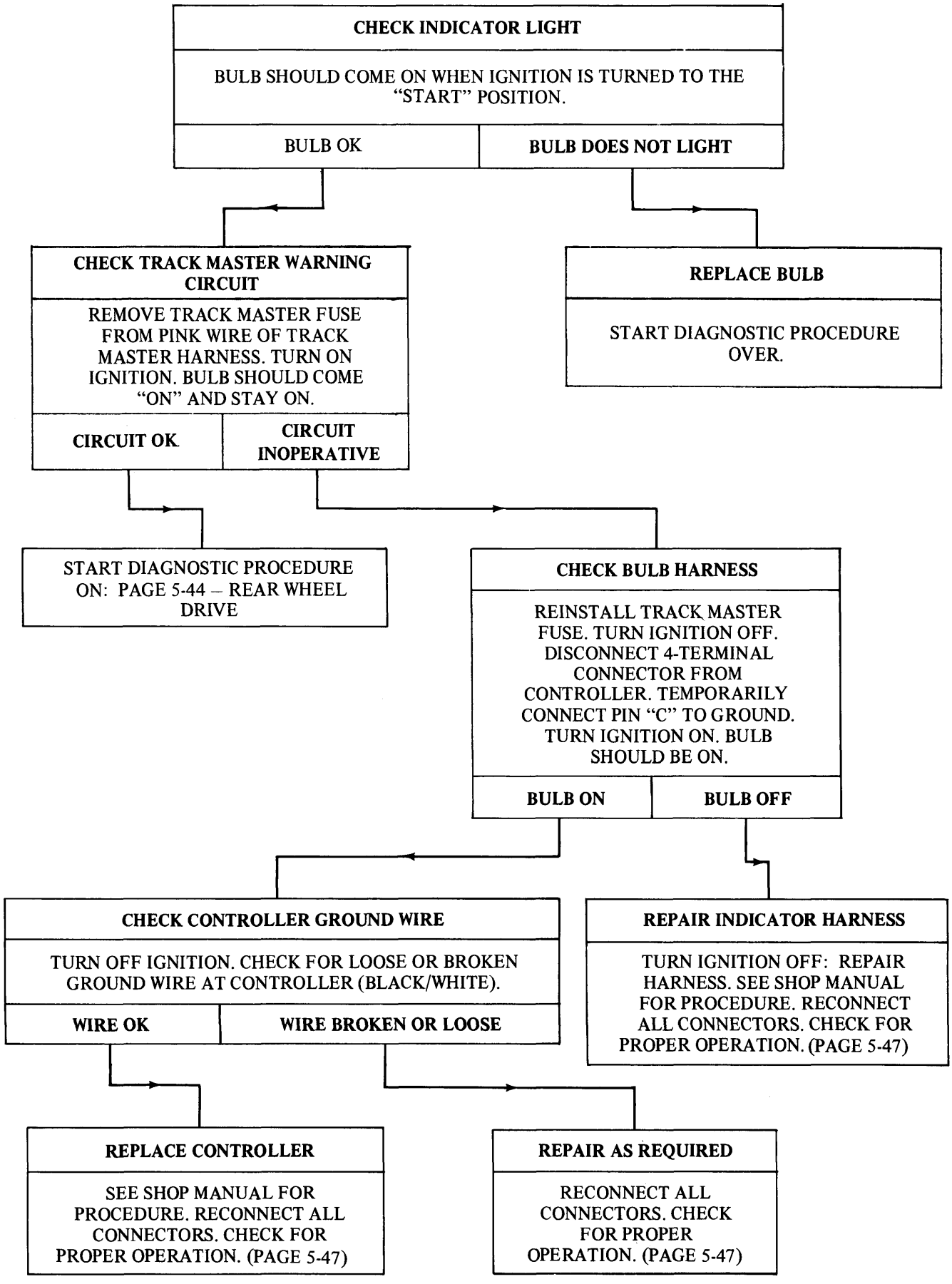
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TRACK MASTER DIAGNOSIS CHART (Cont'd.)

CONDITION	CORRECTION
12. TRACK MASTER DOES NOT WORK – WHEELS LOCK UP. WARNING LIGHT NOT ON. NOTE: THE TRACK MASTER SYSTEM CONTAINS AN AUTOMATIC SHUTDOWN FEATURE WHICH DISABLES THE SYSTEM IN THE EVENT OF A MALFUNCTION WHICH LIGHTS THE INDICATOR LIGHT.	A. CHECK FOR LOOSE OR BROKEN CONTROLLER GROUND WIRE (BLACK/WHITE). B. CHECK FOR LOOSE SPEEDO DRIVE GEAR ON TRANSMISSION OUTPUT SHAFT, EXCESSIVE SIDE-TO-SIDE CLEARANCE, AND EXCESSIVE ROUGHNESS DURING ROTATION OF SENSOR DRIVE SHAFT. C. CHECK INDICATOR LIGHT FUNCTION ON PAGE 5-40. D. START DIAGNOSTIC PROCEDURE ON PAGE 5-44.

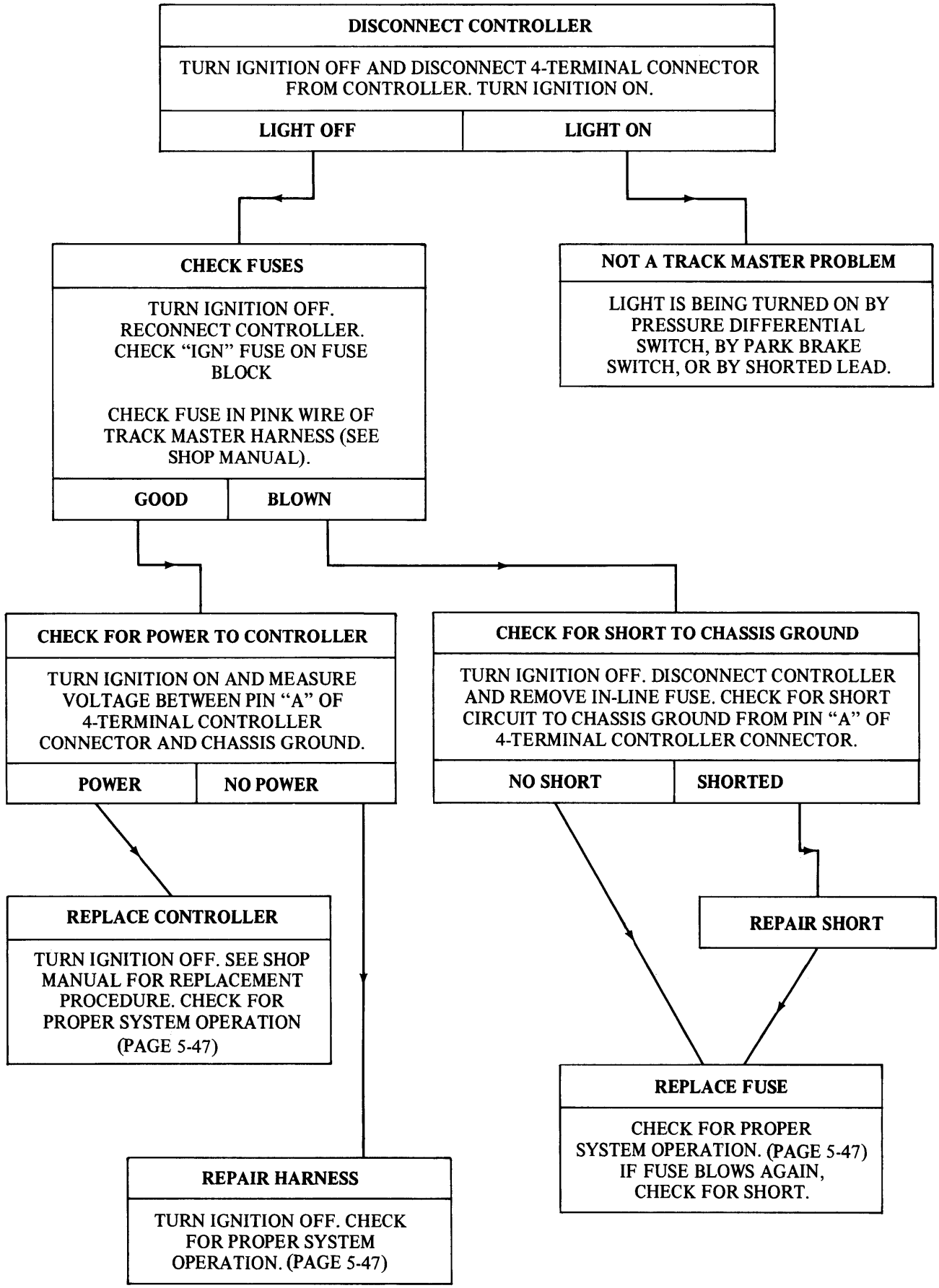
BACK TO INDEX

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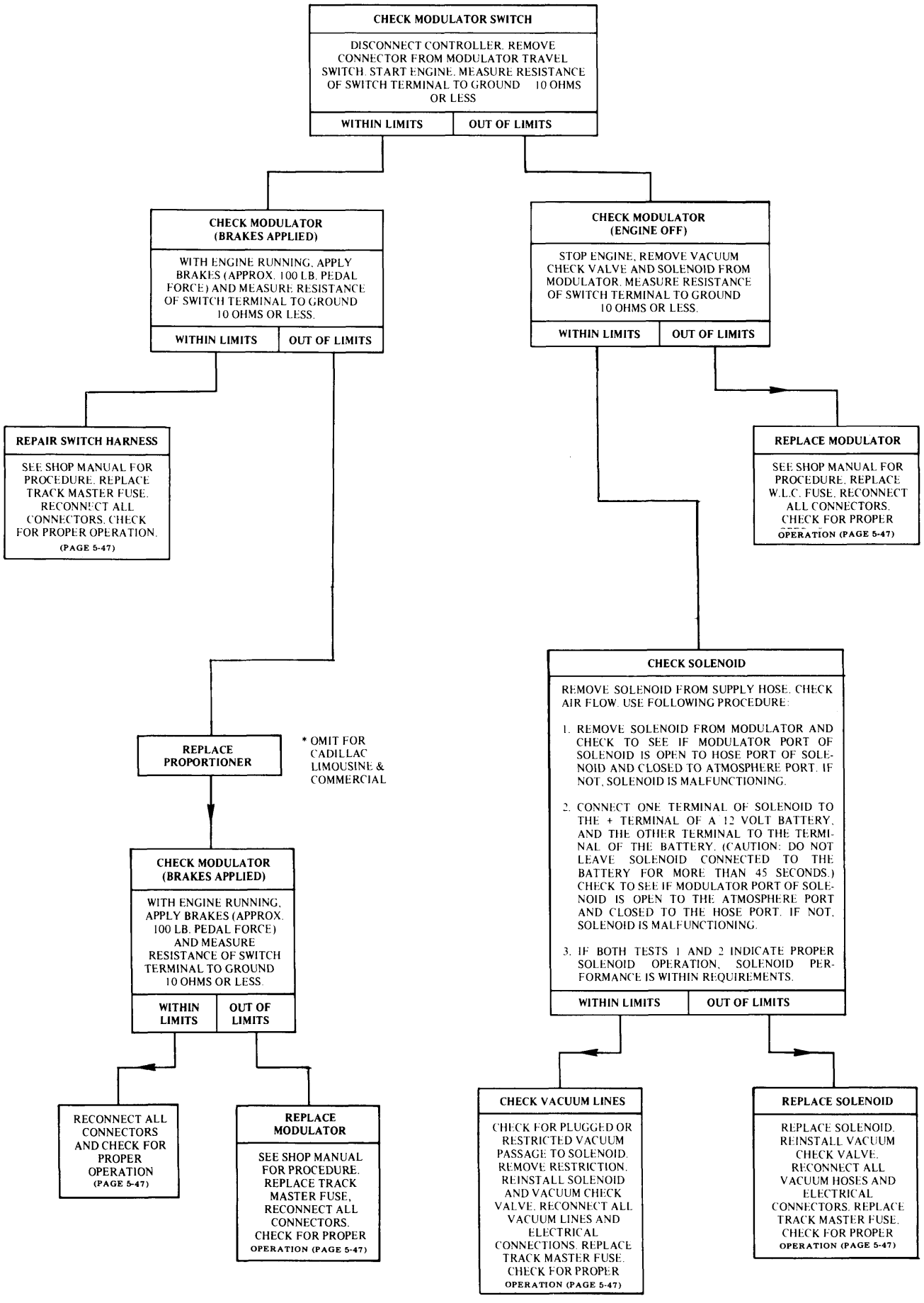
BACK TO INDEX

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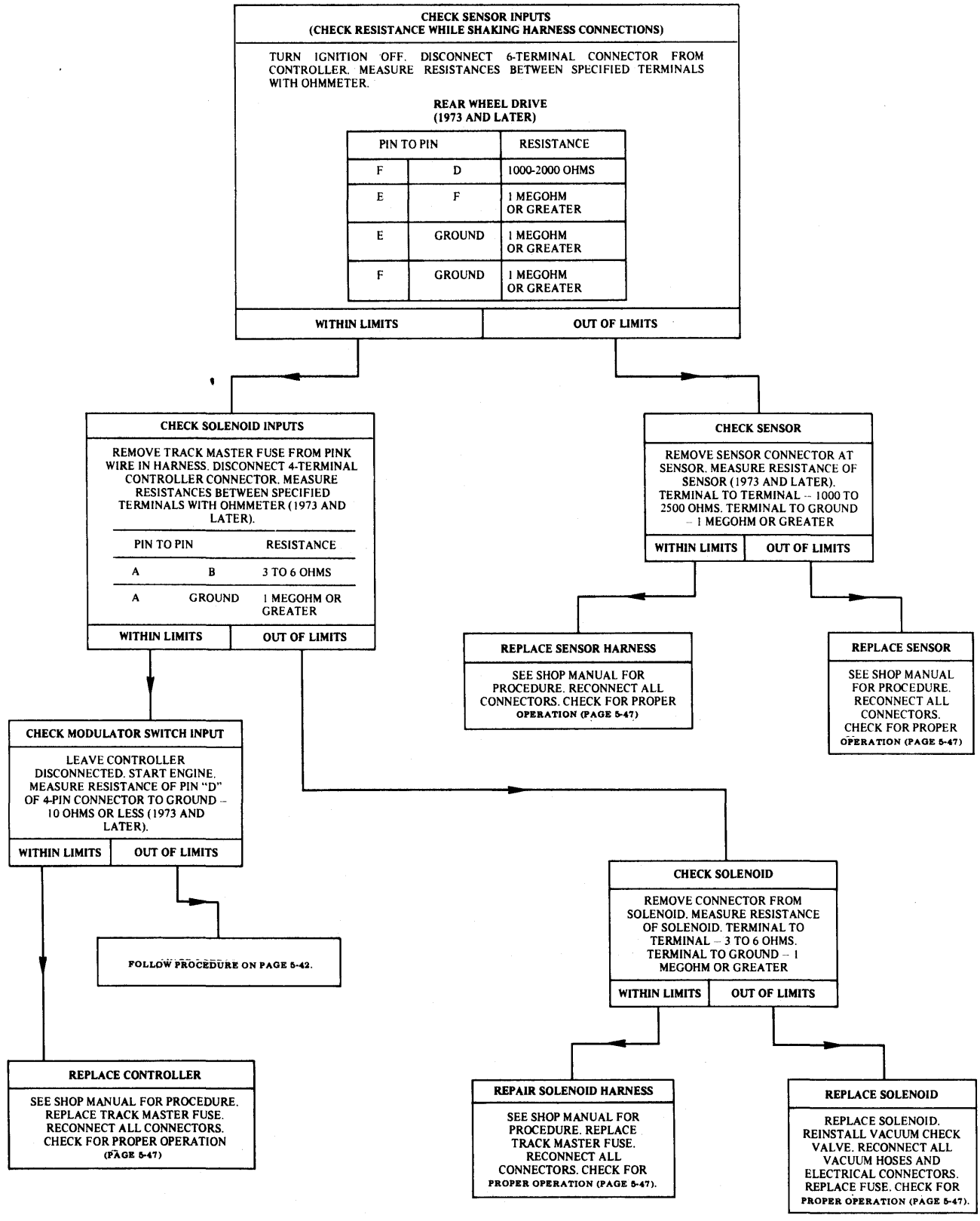
BACK TO INDEX

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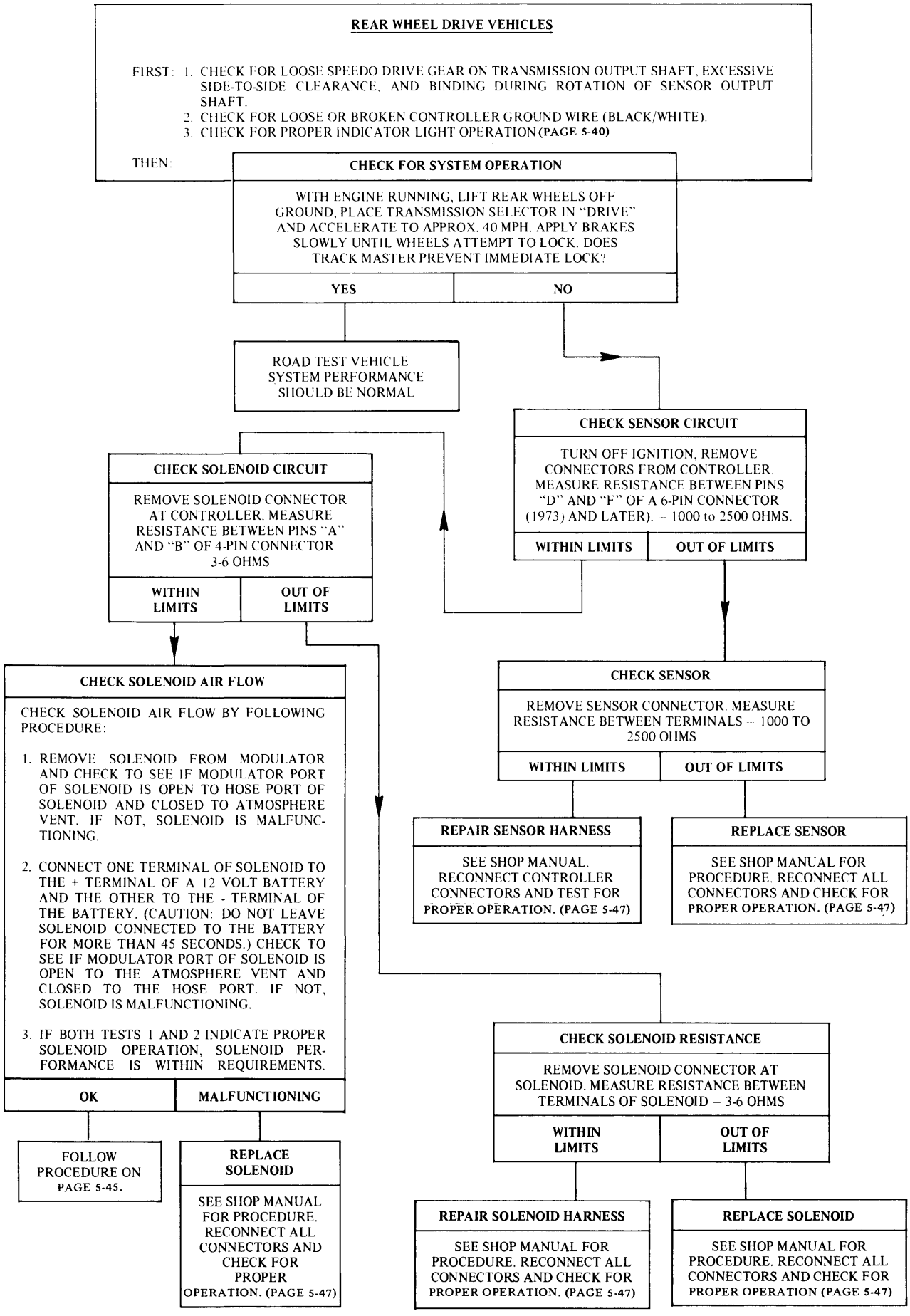
BACK TO INDEX

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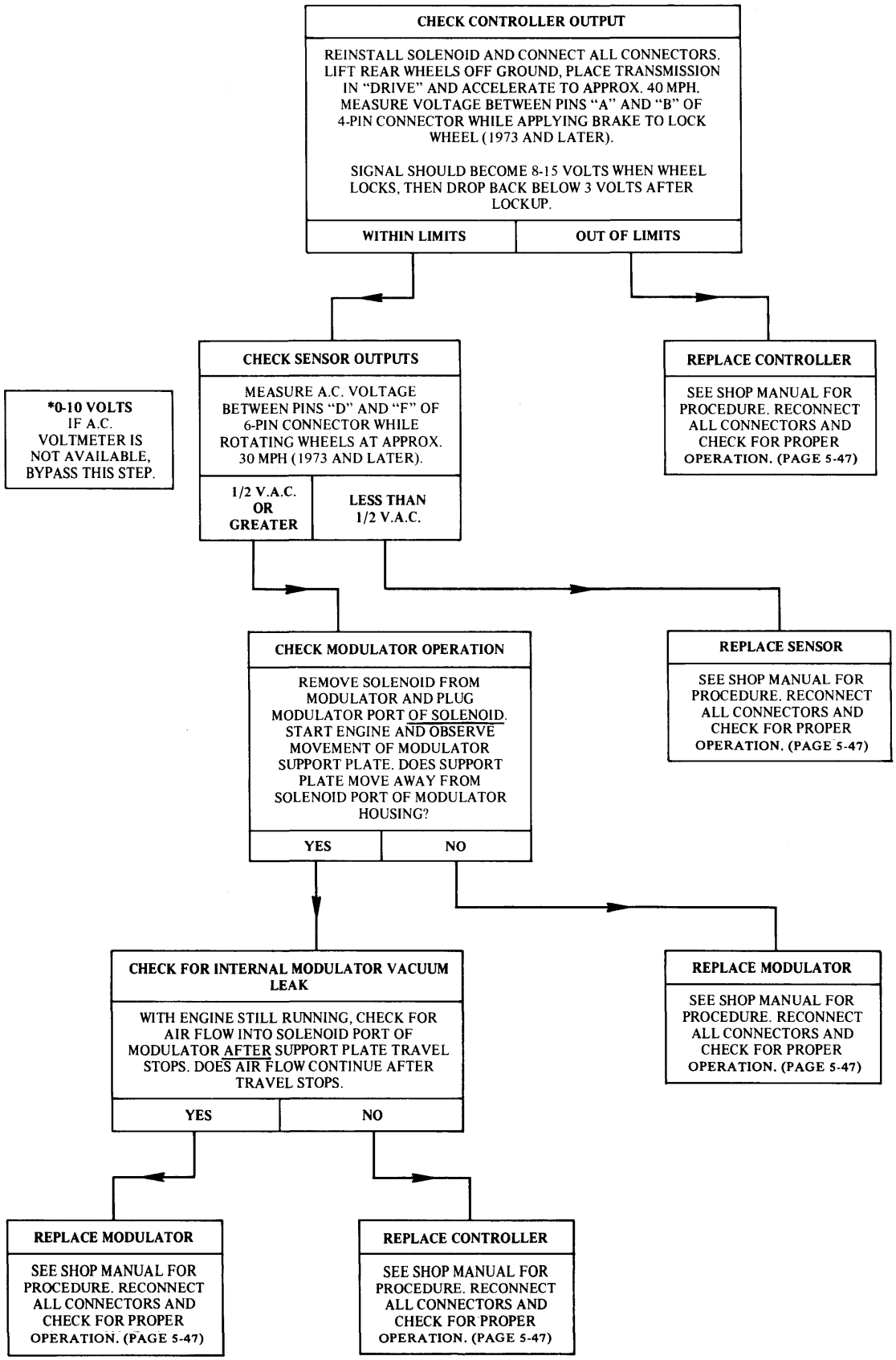
BACK TO INDEX

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BACK TO INDEX

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BACK TO INDEX

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BACK TO INDEX

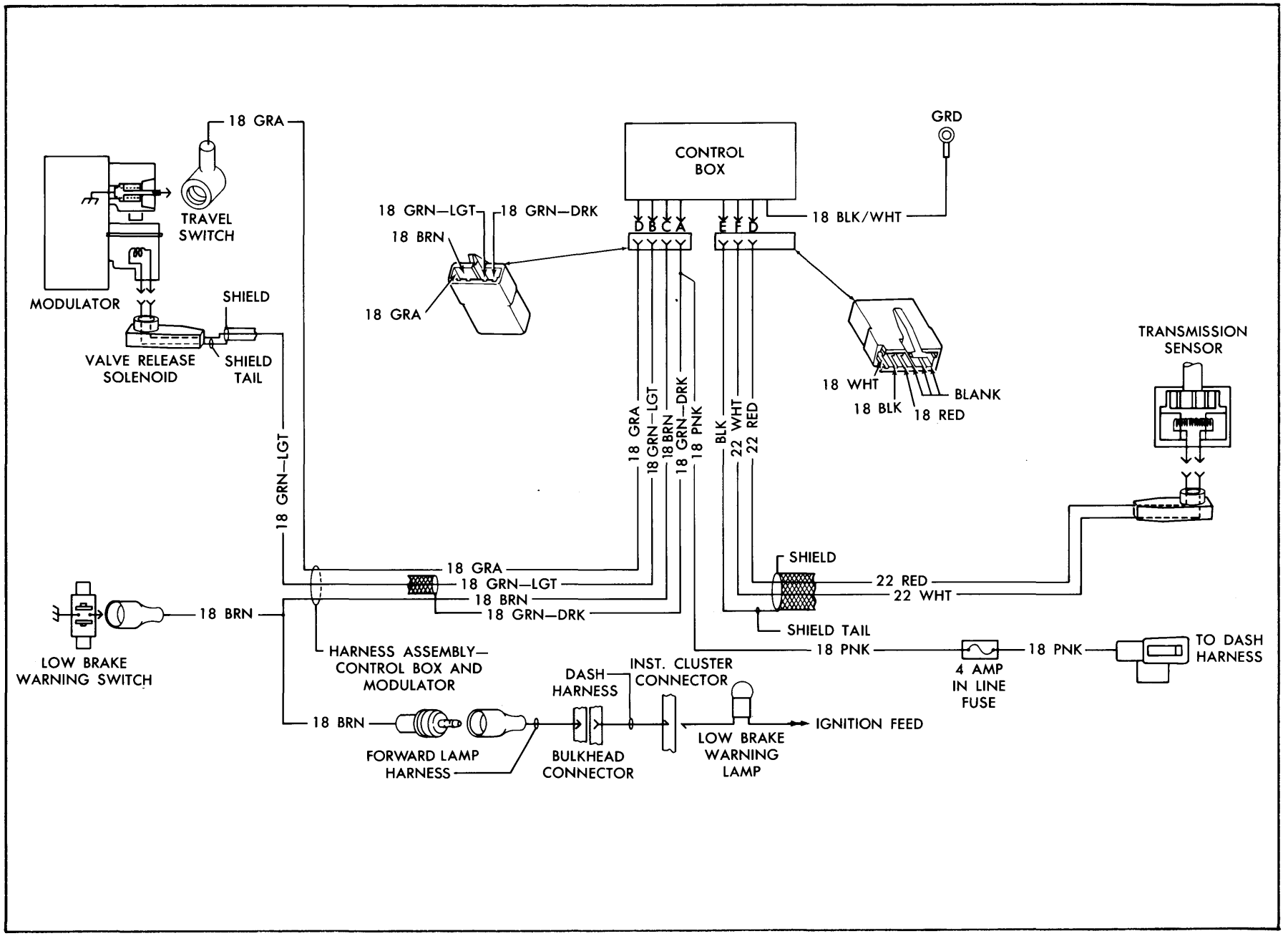


Fig. 5-51 Circuit Diagram

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BASIC CHECK FOR PROPER TRACK MASTER SYSTEM OPERATION REAR WHEEL DRIVE VEHICLES

1. Turn ignition switch from "OFF" to "ON". Modulator should cycle one time producing a "clicking" sound, and brake indicator light should remain "OFF".

2. Lift rear wheels off ground, start engine, and place transmission in drive. Accelerate to approximately 40 mph. Apply brakes slowly until wheels attempt to lock. Track Master should prevent immediate lock, and brake indicator light should remain "OFF".

3. Decrease speed to approximately 10 mph and hold speed constant. There should be no modulator cycling during constant speed operation, and brake indicator light should remain "OFF".

4. Shift to neutral and stop wheels. Apply brakes (approximately 100 lbs. pedal force). "Brake" indicator light should remain off.

SERVICE INFORMATION

CAUTION: To prevent controller damage never operate the Trackmaster System unless the controller has a good ground. Never reverse battery polarity and always connect battery booster cables positive to positive and negative to negative.

31. Transmission Speed Sensor (Fig. 5-52)

a. Removal

1. Disconnect speedometer cable at transmission sensor.

2. Release clamp at harness connector and remove connector from sensor being careful not to twist connector as this may crack the sensor body.

3. Remove one bolt, retainer and spacer securing sensor to transmission.

4. Remove sensor from transmission.

b. Installation

1. Install sensor with speedo gear in transmission.

2. Install spacer, retainer and bolt securing sensor to transmission.

3. Install harness connector packed with front

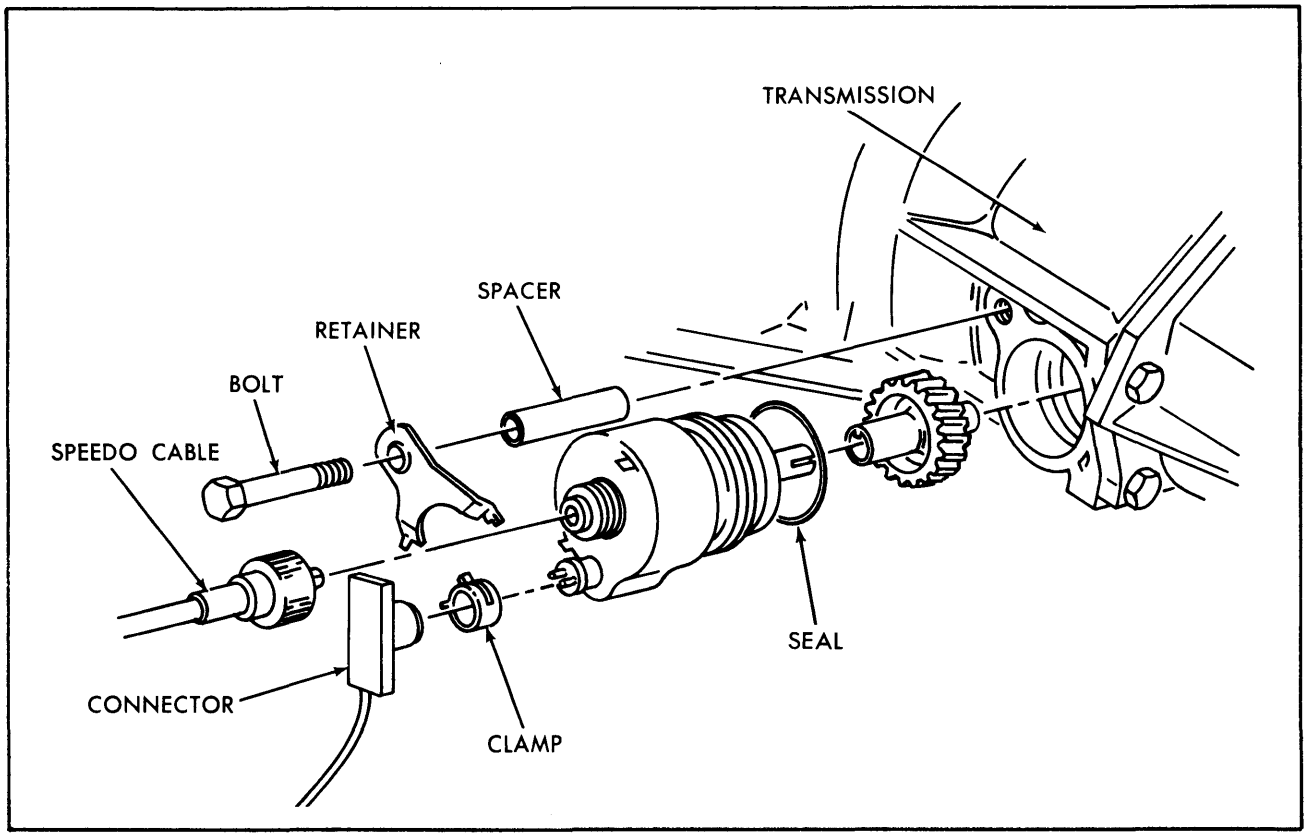


Fig. 5-52 Transmission Sensor Installation

BACK TO INDEX

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wheel bearing grease to sensor and secure with clamp being careful not to twist connector as this may crack the sensor body.

4. Connect speedometer cable to sensor.

32. Controller

a. Removal

1. Working through top of glove box remove the electrical connectors from the upper right hand side of the controller.
2. Loosen two screws securing controller mounting bracket to horizontal support.
3. Remove controller and bracket by lifting up and out through glove box.

b. Installation

1. Working through top of glove box install controller and bracket on horizontal support screws.
2. Tighten screws securing controller to horizontal bracket.
3. Connect electrical connectors to upper right hand side of controller.

(NOTE: Connectors are not interchangeable. Front connector is notched.)

33. Modulator

a. Removal

1. Disconnect negative battery cable.
2. Disconnect travel switch and solenoid connectors at modulator.
3. Remove vacuum hose at check valve assembly.

(NOTE: The only serviceable components of the modulator are the check valve assembly, solenoid assembly and modulator without check valve or solenoid.)

4. Disconnect two brake lines at modulator assembly.
5. Remove three screws that secure modulator to cowl and remove modulator.

b. Installation

1. Install modulator on cowl and secure with three screws. Tighten screws to 85 inch pounds.
2. Connect solenoid and travel switch connectors.
3. Install solenoid and check valve assemblies with vacuum hoses attached.
4. Secure two brake lines at modulator assembly.
5. If pressure bleeding equipment is available, proceed to Step 6. If not, proceed to Step 12.
6. Remove master cylinder reservoir cover and seal assembly and fill both reservoirs with brake fluid.
7. Install Bleeder Adapter, J-22489-1 and J-22489-12 cables on master cylinder and connect bleeder hose to Bleeder Adapter Cover.
8. Build up pressure in bleeder 30 psi minimum and bleed system at modulator as described in Steps 9 and 10.
9. Attach drain hose at bleeder fitting.
10. Back off fitting one-half turn and bleed brake fluid into a partially filled bottle of clean brake fluid until bubbles stop, then close fitting.
11. Raise car on hoist and first bleed right rear and then left rear brake following procedure outlined in Steps 9 and 10. Proceed to Step 15.
12. If a pressure bleeder is not available the following two man procedure may be used to bleed the rear brakes. Fill both master cylinder reservoirs with brake fluid.

(NOTE: Keep reservoirs at least partially filled at all times during bleeding operation.)

13. Bleed system at bleeder fittings in the following order: modulator; right wheel; left wheel; using procedure described in Step 14.
14. Attach drain hose to bleeder fitting. Apply pressure to brake pedal, back off fitting one-half turn, and depress brake pedal. Close bleeder fitting before releasing pressure on brake pedal. Repeat applications until bubbles stop.
15. Master cylinder reservoir level should be 1/8" to 3/8" from top. Before driving car, be sure a firm pedal is obtained.
16. Connect negative battery cable.

34. Solenoid

a. Removal

1. Remove vacuum hoses.
2. Remove solenoid connector.
3. Remove solenoid.

b. Installation

1. Install solenoid on modulator, securing two vacuum hoses.
2. Install solenoid connector.

35. Controller and Modulator Harness

a. Removal

1. Disconnect solenoid and travel switch connectors at modulator.
2. Disconnect brown wire at underhood harness connector on left wheelhouse.
3. Remove top screw and loosen lower screw securing grommet retainer to firewall and remove split grommet. Push harness through cowl.
4. Remove upper instrument panel cover as described in Section 12, Note 40a.
5. Route harness to top of instrument panel area.
6. Disconnect single pink wire connector that leads to fuse block.
7. Disconnect four-way controller connector.
8. Remove controller and modulator harness.

b. Installation

1. Position harness on top of instrument panel area and route to pink lead to controller.
2. Connect four-way controller connector.
3. Connect single pink wire connector that leads to fuse block.
4. Route harness through cowl.

BACK TO INDEX

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5. Connect solenoid and travel switch connectors at modulator.

6. Connect brown wire connector at underhood harness connector on left wheelhouse.

7. Install split grommet in retainer and install top screw and tighten lower screw securing grommet retainer to cowl.

8. Install upper instrument panel cover as described in Section 12, Note 40b.

THEORY OF OPERATION — ELDORADO

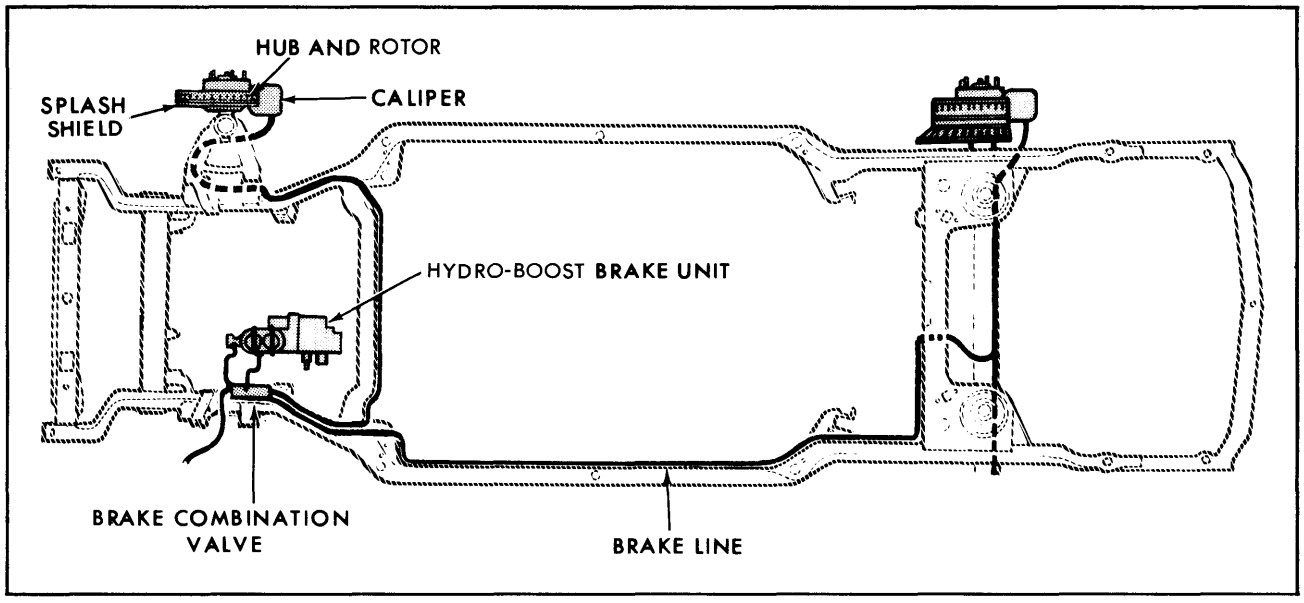


Fig. 5-53 Location of Components—Eldorado

(NOTE: The following information pertains only to the Eldorado, Fig. 5-49.)

A four wheel disc brake system with Hydro-boost is used exclusively on the Eldorado.

New 11 inch diameter single, piston-type disc brakes with an integral parking brake with automatic adjusting provisions and new brake linings are used in the rear. The front and rear brake caliper and lining are not interchangeable.

Front Disc Brakes

The single piston sliding caliper front disc brake used on the Eldorado is serviced in the same manner as those installed on other Cadillac cars. The following items are distinctive to the Eldorado.

Hub and Rotor

The Eldorado rotor is loose mounted or "floating" as opposed to an integral unit on other cars. The rotor and hub are separate components so that rotor replacement does not require replacing the hub and bearings. The rotor is held in place by lug nuts and may be removed as easily as a brake drum once the caliper is removed. The rotor is 11" in diameter on the Eldorado only.

Brake Combination Valve

The combination valve is mounted on a bracket to the rear of the left side upper shock absorber mounting bracket and is secured to the frame side rail by two tapping screws. No metering valve function is used with four wheel disc brakes.

The remaining service operations on the combination valve remain unchanged.

Single Piston Sliding Caliper Rear Disc Brakes (Caliper Functional Description) (Fig. 5-54)

The cone and piston move out as one part upon hydraulic apply. The nut remains stationary on the high lead screw, and a gap develops between the cone and nut.

Assuming some lining wear, the cone and piston do not return to their starting position (leaves a small gap equal to lining wear between cone and nut).

A 50 pound adjusting spring causes the nut to rotate on the high lead screw to close the gap (caliper has adjusted).

For a mechanical park brake apply, the lever is rotated by means of a conventional cable apply mechanism.

Lever rotation causes the high lead screw to turn,

BACK TO INDEX

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which causes the nut to progress down the screw, loading thru the cone and the cone/clutch interface of the piston, resulting in a clamp load on the linings.

The caliper adjusts only when there is no pressure over the cone, thus, allowing it to rotate on the clutch interface (it will not automatically adjust on hydraulic apply).

The clutch interface prevents the cone from turning when the parking brake is applied.

BRAKE DIAGNOSIS CHART—ELDORADO

NOTE: Operation of Tell-Tale Brake Light may be checked as outlined in Note 28.

CAUSE / Symptom	Excessive Brake Pedal Travel	Brake Pedal Travel Gradually Increases	Excessive Brake Pedal Effort	Excessive Braking Action	Brakes Slow to Respond	Brakes Slow to Release	Brakes Drag	Uneven Braking Action (Side to Side)	Uneven Braking Action (Front to Rear)	Scraping Noise from Brakes	Brakes Squeak During Application	Brakes Squeak During Stop	Brakes Chatter (Roughness)	Brakes Groan at End of Stop	Brakes Tell-Tale Glows	Excessive Parking Brake Pedal Travel	No Reserve Stopping
Leaking Brake Line or Connection	X	XX	X						X						XX		
Leaking Piston Seal	X	XX	X	X				X							X		
Leaking Master Cylinder	X	XX	X												X		
Air in Brake System	XX		X						X						XX		
Contaminated or Improper Brake Fluid	X				X	X	X								X		
Damaged Power Head *			X	X	X	X	XX										XX
Worn Out Brake Lining			X	X				X	X	X	X	X		X			
Uneven Brake Lining Wear - Replace	X			X				X	X	X	X	XX		X	X		
Glazed Brake Lining - Sand			XX		X			X	X		X	X					
Incorrect Lining Material - Replace			X	X				X	X			X		X			
Contaminated Brake Lining - Replace				XX				XX	XX	X	X	X		X			
Heat Spotted or Scored Rotors				X				X	X		X	X	XX	X			
Out-of-Parallel Brake Rotor	X												XX				
Excessive Rotor Run-Out	X												X				
Faulty Rear Caliper Automatic Adjusters							X	X	X							X	
Brake Assembly Attachments - Missing or Loose	X						X	X	X	X		X	X	X			
Restricted Brake Fluid Passage		X	X		X	X	X	X	X						X		
Improperly adjusted Stoplight Switch or Cruise Control Vacuum Dump							X										
Faulty Proportioning Valve			X	X	X	X	X		X								
Brake Pedal Linkage Interference or Binding			X		X	XX	XX										
Improperly Adjusted Parking Brake Cables							X									X	
Incorrect Front End Alignment								XX									
Incorrect Tire Pressure								X	X								
Incorrect Wheel Bearing Adjustment	X									X			X				
Loose Front Suspension Attachments							X	X		XX			X	X			
Out-of-Balance Wheel Assemblies													XX				
Incorrect Body Mount Torque Need to Slightly Increase or Decrease Pedal Effort													X	XX			
Operator Riding Brake Pedal			X				X		X					X			
Sticking Caliper							XX										

XX – Indicates more probable cause(s)
X – Indicates other causes
* – See Hydro-boost Diagnosis

BACK TO INDEX

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DIAGNOSIS

If excessive parking brake pedal travel, adjust parking brake cables and check pedal travel. If pedal travel is correct but, upon releasing, adjusting levers are off the stops, either return springs are faulty or automatic adjusters are not adjusting. Replace return springs or piston and screw assemblies as necessary.

(NOTE: Levers must be on caliper stops after completion of adjustment.)

SERVICE INFORMATION

(NOTE: The service information that follows pertains only to the Eldorado. For service procedures not given, refer to the forward portion of this section, as these procedures are the same as for the other Cadillac models.)

36. Rotor Assembly Removal and Installation (Front)

a. Removal

1. Raise car and remove front wheel.
2. Remove two bolts which hold caliper to steering knuckle.

(NOTE: It is not necessary to remove brake hose from caliper when removing rotor for service.)

3. Remove cotter pin, loosen upper spherical joint nut and slip brake hose collar out of its clip. The slack gained will permit removal of caliper without pulling hose.
4. Slide caliper off rotor and support by a hook-shaped wire fastened to upper suspension arm.

CAUTION: Do not allow caliper to hang from brake hose as this could result in possible damage to hose.

5. Mark a wheel stud and a corresponding place on the rotor to assist in installation.
6. Remove the rotor by sliding it off the hub.

b. Installation

1. Inspect hub flange and rotor mating surfaces to make sure that they are free of dirt and other foreign material. Clean as required.
2. If reinstalling original rotor, align index marks on hub and rotor and slide rotor over hub pilot diameter, making sure that rotor is seated against hub flange.

(NOTE: If rotor replacement is necessary, the new rotor may be assembled to the hub in any position. It is not necessary to replace both rotors if one is all right.)

3. Position caliper on rotor and line up holes in caliper ears with holes in steering knuckle. Make sure brake hose is not twisted, as its natural curvature is essential to maintain proper hose-to-suspension clearance through full movement of suspension and steering parts.
4. Wipe all dirt and corrosion from the caliper mounting bolts. Do not use abrasives, as they will remove protective plating. Lubricate smaller ends of bolts with silicone lubricant.
5. Start either bolt into the inboard ear of the caliper and into the steering knuckle. At this point it is necessary to be sure that the bolt passes under the retaining ear on the inboard shoe to maintain the shoe in position in the caliper, Fig. 5-15.
6. Pass the bolt on through the outboard ear on the caliper until the threads on the bolt can be started into the steering knuckle.
7. Repeat steps 5 and 6 in placing remaining bolt into caliper assembly.

See CAUTION page 5-8, prior to NOTE 6 for steps 8, 12, 13.

8. Tighten caliper mounting bolts to 30 foot-pounds.
9. Pump brake pedal to seat lining against rotors.
10. Clinch upper ears of outboard shoe by positioning 12" pliers with one jaw on top of upper ear and one jaw in notch on bottom of shoe, opposite upper ear, see Fig. 5-16.

(NOTE: After clinching, there should be no radial clearance between the shoe ears and caliper housing.)

11. If radial clearance exists, repeat clinching procedure.
12. Center brake hose collar in clip and tighten spherical joint nut to 60 foot-pounds. Install cotter pin.
13. Install wheels, tighten wheel mounting nuts to 130 foot-pounds and lower car.
14. Allow car weight to be supported on front wheels and inspect front brake hoses for twisted condition. If necessary, correct as described in Note 42b.
15. Before moving the vehicle, pump the brake pedal two or three times to insure firm pedal.

37. Rear Brake Caliper (Fig. 5-54)

a. Removal

CAUTION: Power steering fluid and brake fluid cannot be mixed. If brake seals contact steering fluid or steering seals contact brake fluid, seal damage will result.

1. Remove two thirds of total fluid capacity in front master cylinder reservoir and discard fluid.

(NOTE: Removing fluid prevents reservoir overflow when the piston is pushed back in its bore to remove the caliper.)

2. Raise car on hoist.
3. Remove wheel disc and wheel and tire assembly.
4. Install one wheel mounting nut, flat side toward rotor to keep rotor from falling when caliper is removed, Fig. 5-55.
5. Loosen tension on parking brake cable at equalizer.

BACK TO INDEX

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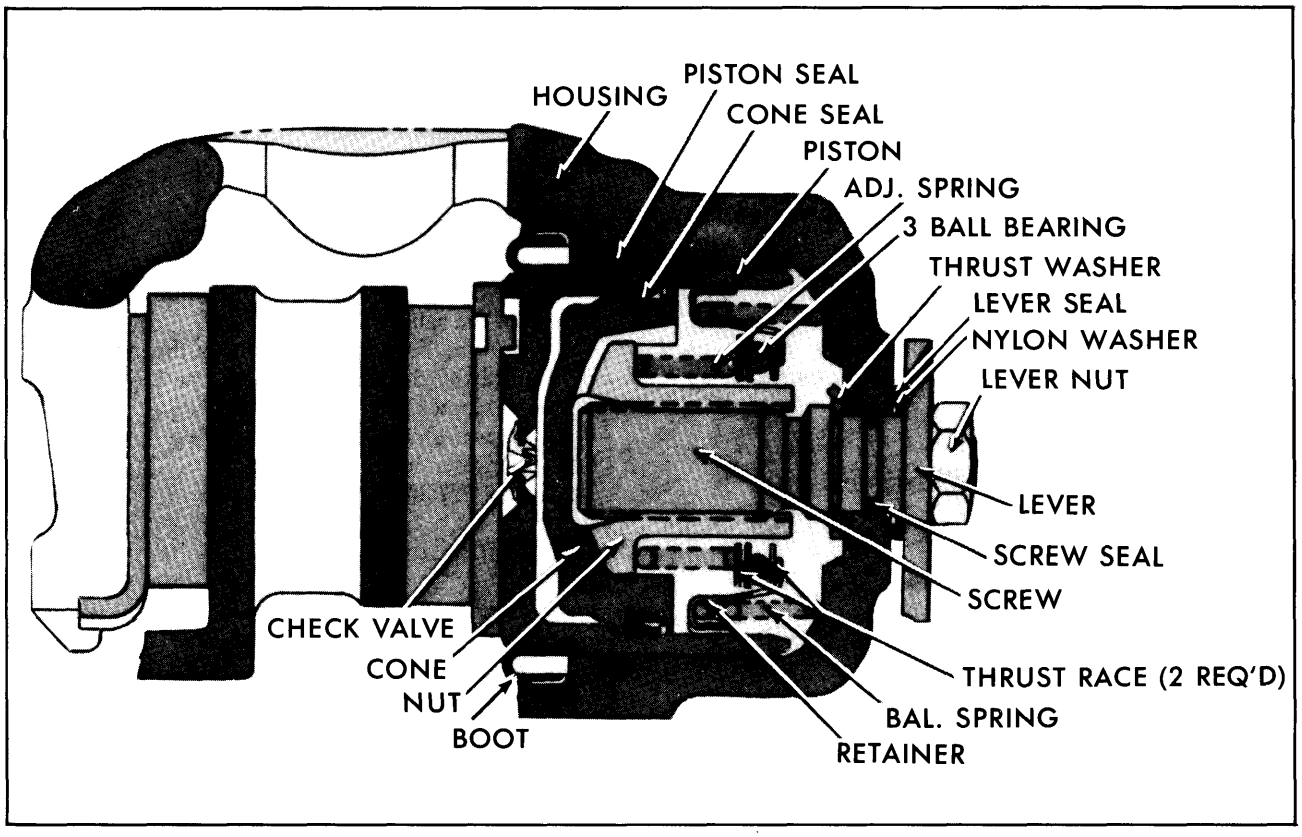


Fig. 5-54 Rear Brake Caliper

6. Remove cable from parking brake lever, Fig. 5-56.

7. Remove return spring, lock nut, lever, lever seal, and anti-friction washer.

(NOTE: Lever must be held in place while removing nut.)

8. Clean any contamination from caliper surface in the area of the lever seal.

9. Using a 7 inch (or larger) "C" clamp with the solid end on the lever stop, Fig. 5-57, and screw end on the back of the outboard lining assembly, turn clamp until piston bottoms in the caliper.

(NOTE: Do not position "C" clamp on actuator screw.)

10. Before removing the clamp, lube the caliper housing surface (under the lever seal), with silicone, Fig. 5-54.

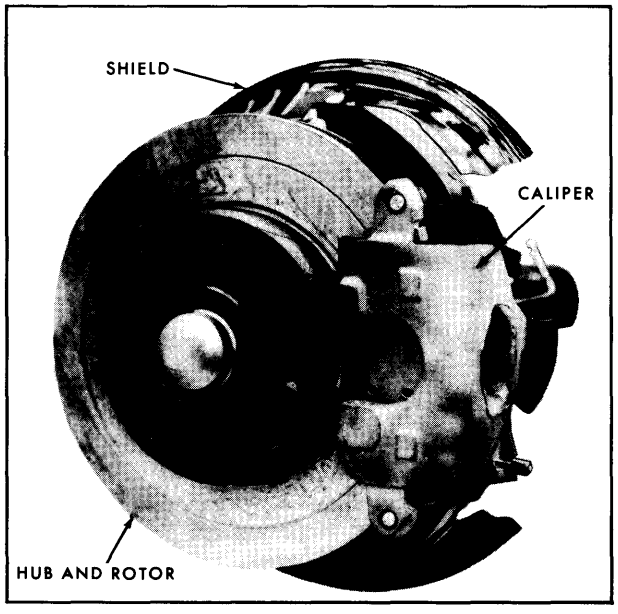


Fig. 5-55 Rear Brake Assembly (Eldorado)

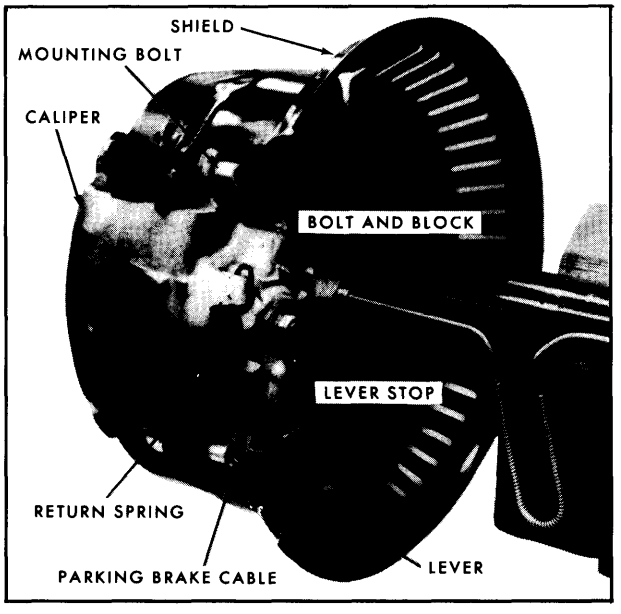


Fig. 5-56 Rear Brake Assembly (Inboard View)

BACK TO INDEX

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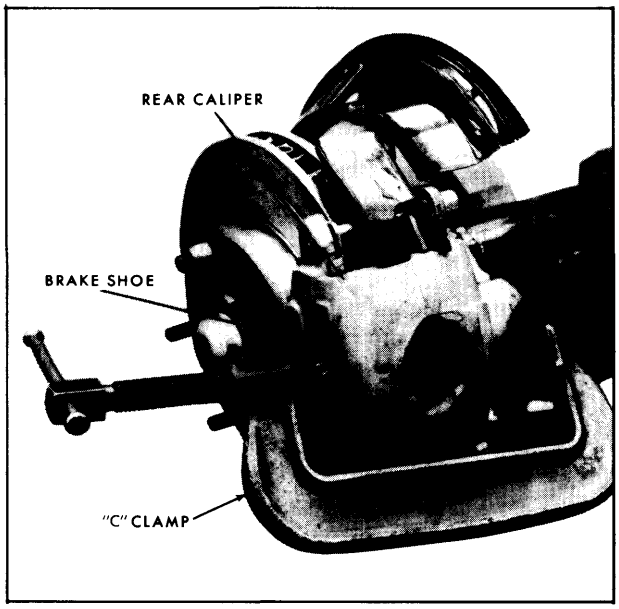


Fig. 5-57 Positioning "C" Clamp on Caliper

11. Install new anti-friction washer, new lever seal and lever.

(NOTE: Install lever on hex with arm pointing downward.)

12. Rotate lever toward front of car and while holding in this position, install nut and torque to 25 foot-pounds. Then rotate lever back to stop.

13. Install lever return spring and remove "C" clamp, Fig. 5-56.

(NOTE: Return springs are color coded, red for right hand caliper and black for left hand.)

14. Remove brake line from caliper and plug openings to retain fluid and prevent entrance of dirt.

(NOTE: If brake line nut is seized, brass bolt and block on caliper can be removed with brake line attached by removing bolt, and block copper washers after removing caliper mounting bolts. Be sure to plug openings.)

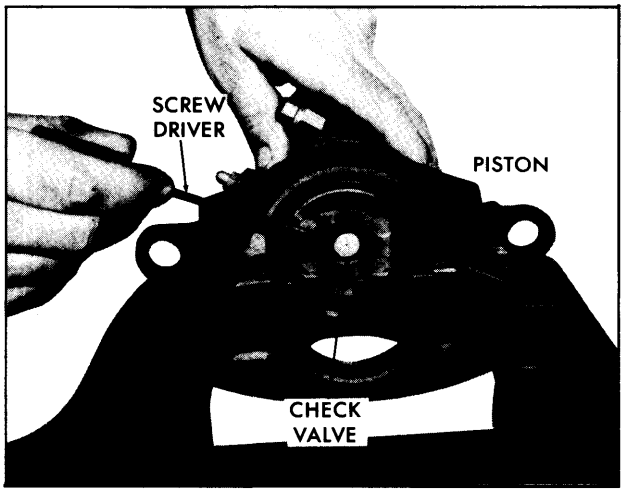


Fig. 5-58 Removing Piston Check Valve

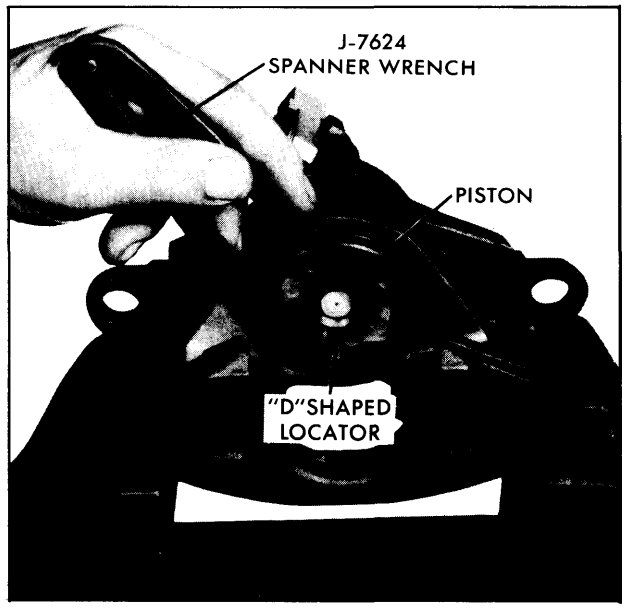


Fig. 5-59 Turning Piston in Bore

15. Remove caliper mounting bolts and remove caliper together with brake shoes; then remove shoes.

b. Inspection

1. Clean dirt and corrosion from face of piston.
2. Examine piston and check valve area for fluid leaks by looking for excessive moisture around boot area. Check dust boot for cuts, cracks or other damage which would affect its ability to seal piston bore. If leaks are present replace dust boot.

CAUTION: Do not use air for cleaning caliper because of the possibility of unseating dust boot.

3. Check piston boot seal for leaks. Replace piston seal and boot seal if leaking.
4. Check for leaks at threaded end of actuator screw. If leaking, replace seal. If bore is scratched or nicked, replace caliper.

c. Lining Replacement

1. Remove and discard two caliper mounting sleeves and four bushings.
2. Using silicone lube, install new bushings and sleeves.

(NOTE: Sleeves are installed in inner bushings.)

3. Remove and discard piston check valve and install new piston check valve, Fig. 5-58.

WARNING: FRONT BRAKE SHOES MUST NOT BE USED ON REAR CALIPERS.

4. Position new inboard shoe assembly on piston. The D-shaped tab must fit in the indentation provided in the piston. If piston requires rotation, use special tool J-7624 to turn it, Fig. 5-59.
5. Install new outboard shoe assembly.
6. Wipe all dirt from caliper mounting bolts. Do not use sand paper or wire brush as this will damage the

BACK TO INDEX

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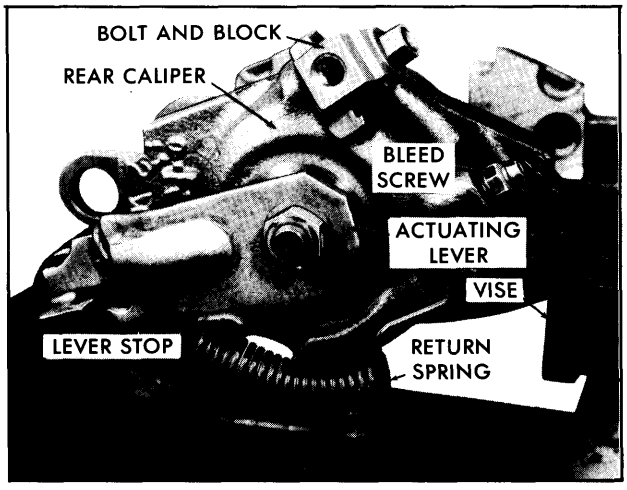


Fig. 5-60 Securing Caliper in Vise

plating. If bolts are corroded or damaged they should be replaced.

d. Installation

(NOTE: If brass bolt and block was removed with brake pipe, unplug fittings and install bolt and block using two new copper gaskets. Torque bolt to 30 foot-pounds maximum.)

1. Slide caliper over rotor and install mounting bolts. Insure that all sleeves, bushings and pins are well lubricated with silicone.

(NOTE: Mounting bolt should go under inboard shoe ears).

2. Torque caliper mounting bolts to 30 foot-pounds.

"See CAUTION on Page 5-8 prior to Note 6," for steps 2-12.

3. Unplug fittings and install brake line tube nut into caliper.
4. Pump brake pedal to seat lining against rotor.
5. Clinch upper ear of outboard shoe by positioning 12" pliers with one jaw on top of upper ear and one jaw in notch on bottom of shoe, opposite upper ear, see Fig. 5-16.

(NOTE: After clinching, there should be no radial clearance between the shoe ears and caliper housing.)

6. If radial clearance exists, repeat clinching procedure.
7. Connect parking brake cables and adjust as outlined in Note 40.
8. Bleed rear brake system as outlined in Note 6.
9. After bleeding, apply brake several times hydraulically (service brake) to insure adjustment.
10. Remove one wheel mounting nut used to retain rotor and install wheel and tire assembly.
11. Lower car.
12. Torque wheel mounting nuts to 130 foot-pounds.
13. Install wheel disc.

38. Rear Brake Caliper Piston Assembly

a. Disassembly

CAUTION: Power steering fluid and brake fluid cannot be mixed. If brake seals contact steering fluid or steering seals contact brake fluid, seal damage will result.

1. Remove caliper from car as outlined in Note 37.
2. Secure caliper in vise as shown in Fig. 5-60.
3. Remove two mounting sleeves and four bushings from caliper and discard.
4. Remove brake shoes and lever return spring.

(NOTE: Pad caliper using shop towels to catch piston and brake fluid when removing piston.)

5. Rotate lever back and forth to move piston out of caliper housing, Fig. 5-61.

(NOTE: If the piston will not move out of the housing by rotating the lever it can be turned out using a wrench. Remove the lock nut, lever, lever seal, and anti-friction washer. Using a 9/16 wrench turn the screw hex clockwise on the right hand caliper and counter-clockwise on the left until the piston pops out of the housing.)

6. Remove piston assembly and balance spring.
7. Remove lock nut, lever, lever seal, and anti-friction washer.
8. Push screw out of the housing, Fig. 5-62.
9. Remove piston seal and boot.
10. Flush caliper housing with clean denatured alcohol to remove all contaminants.
11. All passage ways should be blown out with clean air.

b. Assembly

1. Install new piston seal.

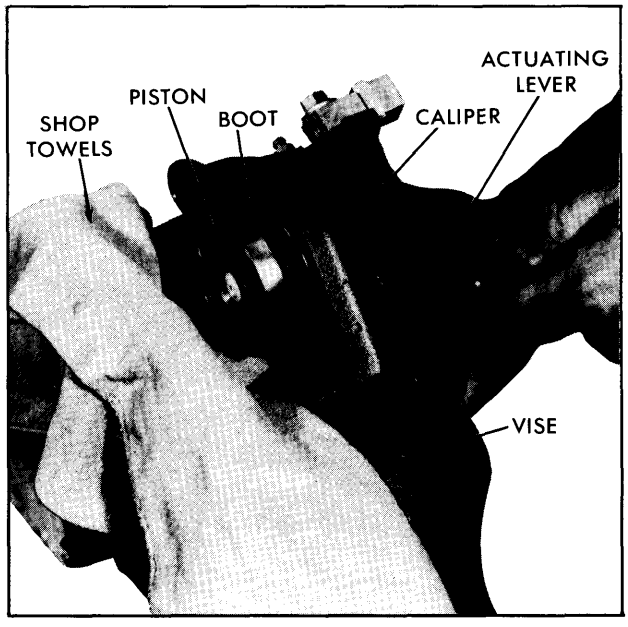


Fig. 5-61 Rotating Lever to Remove Piston

BACK TO INDEX

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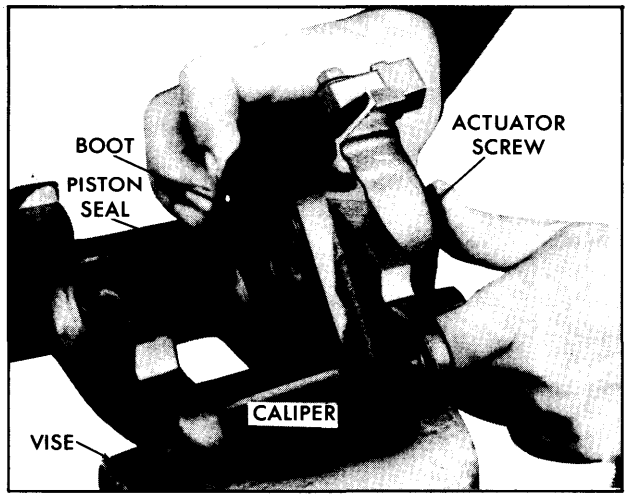


Fig. 5-62 Removing Screw From Housing

2. Install new boot onto new piston assembly. Lip of boot fits in groove provided in piston, Fig. 5-63.

3. Assemble new thrust washer and seal onto new actuator screw.

4. Fit actuator screw in new piston assembly. Piston assemblies are identified by stamped letter on the end of the adjuster nut. "L" designates left and "R" right. These letters should match the letter on the caliper housing.

(NOTE: The caliper and the actuator screw are marked "R" for the right side of the car and "L" for the left or drivers side of the car. The parking brake will not work if these parts are not on correct side of car.)

5. Coat piston seal with a thin film of clean brake fluid.

6. Fit the balance spring into the piston assembly spring retainer and start assembly into caliper housing, Fig. 5-63.

7. Use tool J-23072 to push piston all the way back in the housing, Fig. 5-64.

(NOTE: Piston must be pushed in straight or the actuator screw seal will be damaged as it passes through the hole in the rear of the piston bore.)

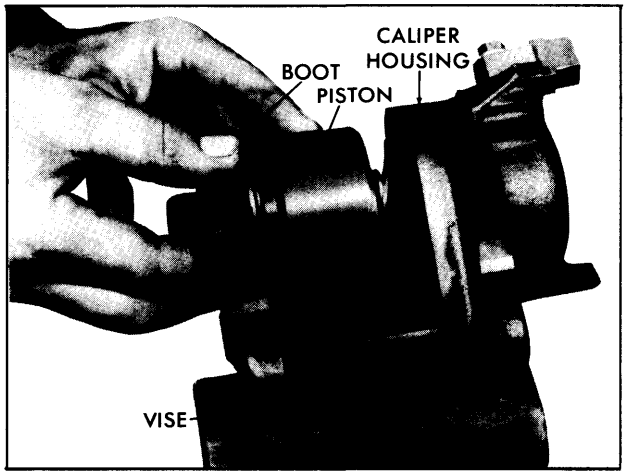


Fig. 5-63 Positioning Piston into Caliper

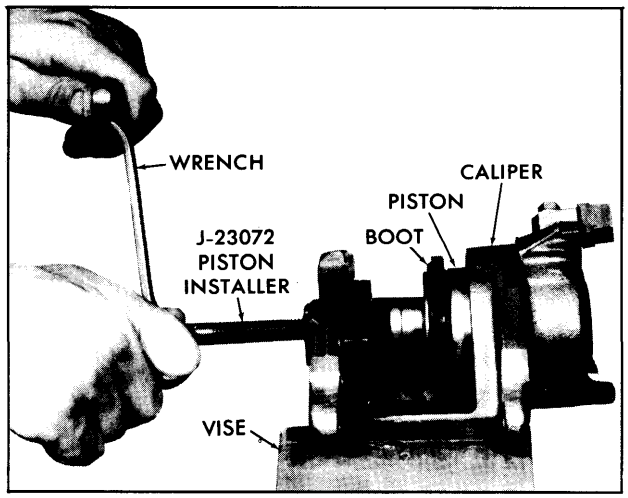


Fig. 5-64 Installing Piston into Housing

8. Before removing tool J-23072, install lubricated anti-friction washer, new lever seal, lever and lock nut, Fig. 5-65.

(NOTE: Install lever away from stop. Rotate forward and hold in position. Torque nut to 25 foot-pounds.

9. Remove tool J-23072, rotate lever back to stop and install return spring.

(NOTE: Return springs are color coded, red for right hand caliper and black for left hand.)

10. Using tool J-26296 drive boot until seal bottoms in housing, Fig. 5-66.

11. Install linings following Note C.

12. Install caliper following Note D.

39. Parking Brake

a. Front Cable

The procedure for removing and installing the front parking brake cable is described in Note 22.

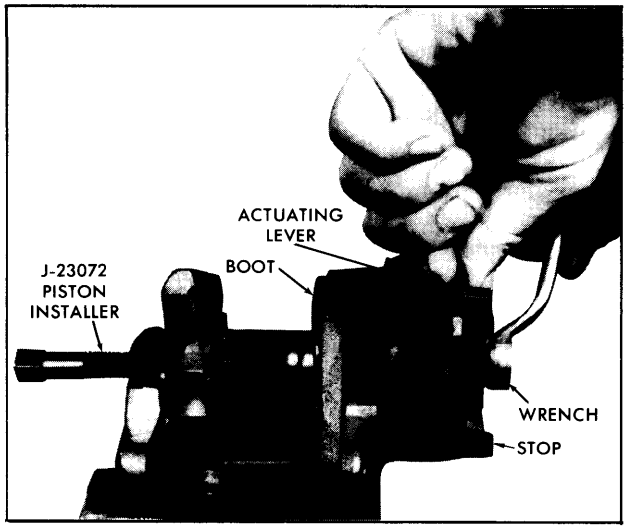


Fig. 5-65 Securing Piston in Housing

BACK TO INDEX

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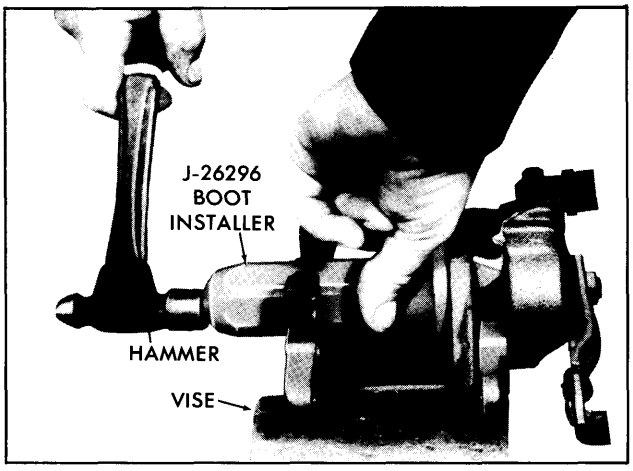


Fig. 5-66 Driving Boot into Housing

b. Removal — Rear Cable

1. Release parking brake.
2. Raise rear of car and position on jack stands.
3. Loosen equalizer nut and remove equalizer.
4. Remove cable from equalizer.
5. Remove clips retaining parking brake cable to lower control arm brackets on left side and at each caliper support plate.
6. Remove cable ends from parking brake actuator.
7. Remove control arm hooks, and remove conduit from exhaust hanger clip.

c. Installation — Rear Cable

1. Connect parking brake cable ends to actuator operating levers.

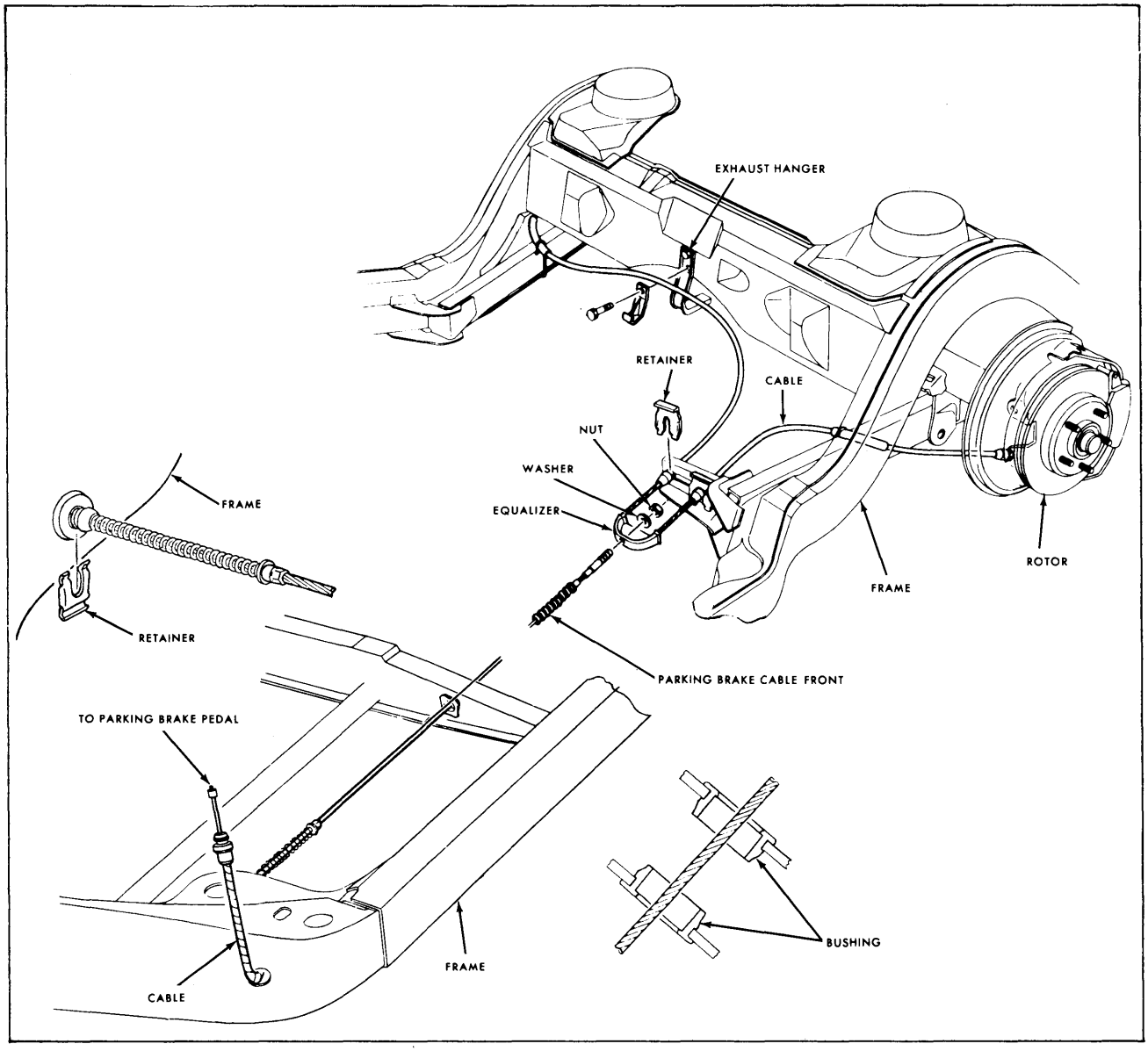


Fig. 5-67 Parking Brake Cables (Eldorado)

BACK TO INDEX

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2. Install retainers at caliper support plates.

(NOTE: Pull on cable and check operation of cable and brake mechanisms.)

3. Position brake cable to lower control arm brackets on left side of car, and secure with clips.
4. Install conduit in exhaust hanger clip.
5. Install cable in equalizer.
6. Tighten equalizer nut.
7. Adjust parking brake as described in Note 40.

40. Parking Brake Adjustment — Eldorado (Fig. 5-67)

1. Lubricate parking brake cables at equalizer hooks and underbody rub points, and check for free movement of all cables.
2. Make sure parking brake pedal is in fully released position.
3. Raise rear wheels off floor.
4. Hold brake cable stud from turning and tighten equalizer nut until cable slack is removed.
5. Make sure caliper levers are against stops on caliper housing.
6. If levers are off stops, loosen cable until levers do return to stops.
7. Operate parking brake pedal several times to check adjustment.

(NOTE: After cable adjustment is performed, parking brake pedal should travel 4 to 5 inches with approximately 125 pounds force on pedal).

8. Lower rear wheels.

(NOTE: Levers must be on caliper stops after completion of adjustment.)

41. Brake Combination Valve

a. Removal

1. Raise hood.
2. Disconnect wiring connector from valve.
3. Disconnect three brake pipes from top and one from rear of valve and remaining brake pipe from bottom of valve.
4. Remove two bolts securing valve to frame bracket and remove valve.

b. Installation

1. Position valve to frame bracket and secure with two bolts.
2. Install brake pipe to bottom of valve and one brake pipe to rear of valve and three on top.
3. Connect wiring connector to valve.

(NOTE: When replacing a combination valve, rear brake bleeding can be accomplished by allowing brake fluid to flow from the rear brake pipe nut at the valve. Back off this nut one turn and catch fluid flow in a clotl. or a container until air is eliminated.

The front brakes should be bled at the calipers in the usual manner. Then, before driving car, be sure a firm pedal is obtained.)

4. Bleed brakes as described in Note 6.
5. Close hood.

42. Servicing Steel Brake Lines and Flexible Hoses

Hydraulic pressure is transferred to the brake calipers through steel brake lines, flexible hoses, and a brake combination valve.

The steel brake lines and flexible hoses should be inspected every spring and fall for damage that may occur from various road hazards.

While the flexible hoses and steel lines require no periodic servicing, it may be necessary to replace damaged hoses or lines in the following manner:

a. Removal—(Front Wheels)

1. Disconnect steel brake line from hose at frame bracket by turning steel tubing nut out of hose fitting. Cap fitting to prevent loss of fluid and entrance of dirt.
2. Remove U-shaped retainer from hose fitting at frame support bracket and remove hose from bracket.
3. Remove cotter pin and nut securing upper spherical joint to knuckle and remove clip securing brake hose to joint stud.
4. If right front hose is being replaced, remove clip retaining hose to frame.
5. Turn hose out of inlet fitting of caliper and remove and discard copper gasket. If hose is to be reused, cap end fittings to prevent dirt from entering hose.

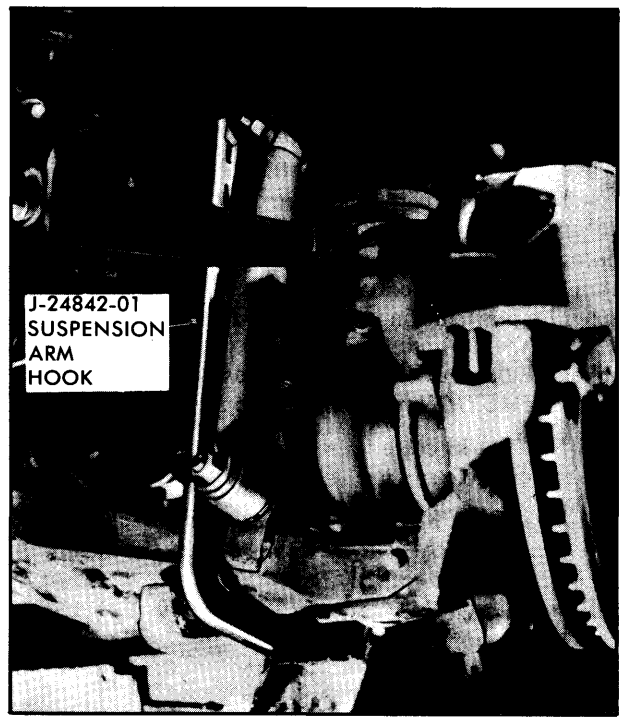


Fig. 5-68 Suspension Arm Hook Installed

BACK TO INDEX

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b. Installation—(Front Wheels)

1. Install new copper gasket on caliper end of hose (male end).
2. Tighten hose in caliper inlet to 30 foot-pounds maximum torque.

CAUTION: Never tighten hose in caliper inlet with hose attached at frame end, as this will twist the hose and may cause possible damage.

3. Install brake hose clip on upper spherical joint stud and install retaining nut on stud. Tighten spherical joint nut finger tight.

When assembling front brake hoses at the frame attachment bracket, front standing height must be set to 13.50 inches as measured along shock absorber from centerline of top mounting bolt to centerline of bottom mounting bolt, before hose is assembled to bracket.

CAUTION: Hose must not be twisted when assembled as possible damage or interference may occur.

This measurement can be obtained by using Tool J-24842. Insert bottom of tool in lower suspension arm below shock mounting bracket. Compress suspension and insert top of tool into upper shock mounting bracket, Fig. 5-68.

(NOTE: Do not twist hose any more than necessary during this operation as its natural curvature is essential to maintain proper hose-to-suspension clearance through full movement of suspension, steering and driving parts.)

4. With suspension in position (front wheels straight ahead) pass female end of hose through frame support bracket, allowing hose to seek its own position. Insert hex of hose fitting into the 12-point hole in support bracket in the position that will require the least twist in hose.
5. Install U-shaped retainer to secure hose to frame support bracket.
6. If right front hose is being replaced, install clip securing hose to frame.
7. Inspect by turning wheels from stop-to-stop while observing hose position. Be sure that hose does not touch any other part at any time during steering travel. If contact does occur, remove hose retainer, and if necessary loosen upper spherical joint nut, and reposition hose as necessary. Replace retainer, tighten spherical joint nut finger tight, and reinspect.
8. When hose is properly positioned, torque spherical joint nut to 60 foot-pounds minimum.

See CAUTION page 5-8 prior to Note 6.

(NOTE: If cotter pin cannot be installed, tighten nut to next hole and install cotter pin.)

CAUTION: When installing cotter pin, make sure ends of pin are pinched tight against flat of nut. DO NOT let end of cotter pin extend down toward outer drive axle seal.

9. Install steel brake line fitting into brake hose at frame support bracket and tighten fitting to 20 foot-pounds maximum torque.
10. Bleed brakes as described in Note 6.

c. Removal—Hydraulic Brake Lines (Rear Wheels)

1. Disconnect steel brake lines at rear caliper junction block. Cap fitting to prevent dirt from entering wheel cylinder.
2. Disconnect brake line at brake line junction fitting on rear axle.
3. If left brake line is being removed, bend clip open and remove line.
4. If right brake line is being removed, bend clips open and remove line.

d. Installation—Hydraulic Brake Lines (Rear Wheels)

1. Position brake line to rear axle and hand start tube nuts into calipers and junction block.
   a. If right brake line is being installed, bend clips over retaining lines to rear axle.
   b. If left brake line is being installed, bend clip retaining line to rear axle.
2. Tighten line to brake line junction fitting on rear axle, tighten to 20 foot-pounds maximum torque.
3. Tighten brake line to rear caliper fitting, tighten to 20 foot-pounds maximum torque.
4. Bleed all brakes as described in Note 6.

e. Removal—Hydraulic Brake Hose (Rear Wheels)

1. Disconnect steel brake line from hose. Cap line.
2. Remove retainer securing forward end of brake hose to frame.
3. Remove bolt from junction block on axle.
4. Disconnect rear axle lines from junction block. Cap lines.

f. Installation—Hydraulic Brake Hose (Rear Wheels)

1. Connect rear axle lines to junction block. Tighten fittings to 20 foot-pounds maximum torque.
2. Bolt junction block to axle.
3. Pass female end of hose through frame allowing hose to seek its own position.
4. Install retainer to secure hose to frame.
5. Place steel tube connector in hose fitting and tighten to 20 foot-pounds maximum torque.

CAUTION: Do not allow hose to twist out of its normal position as this may cause damage.

6. Bleed all brakes as described in Note 6.

BACK TO INDEX

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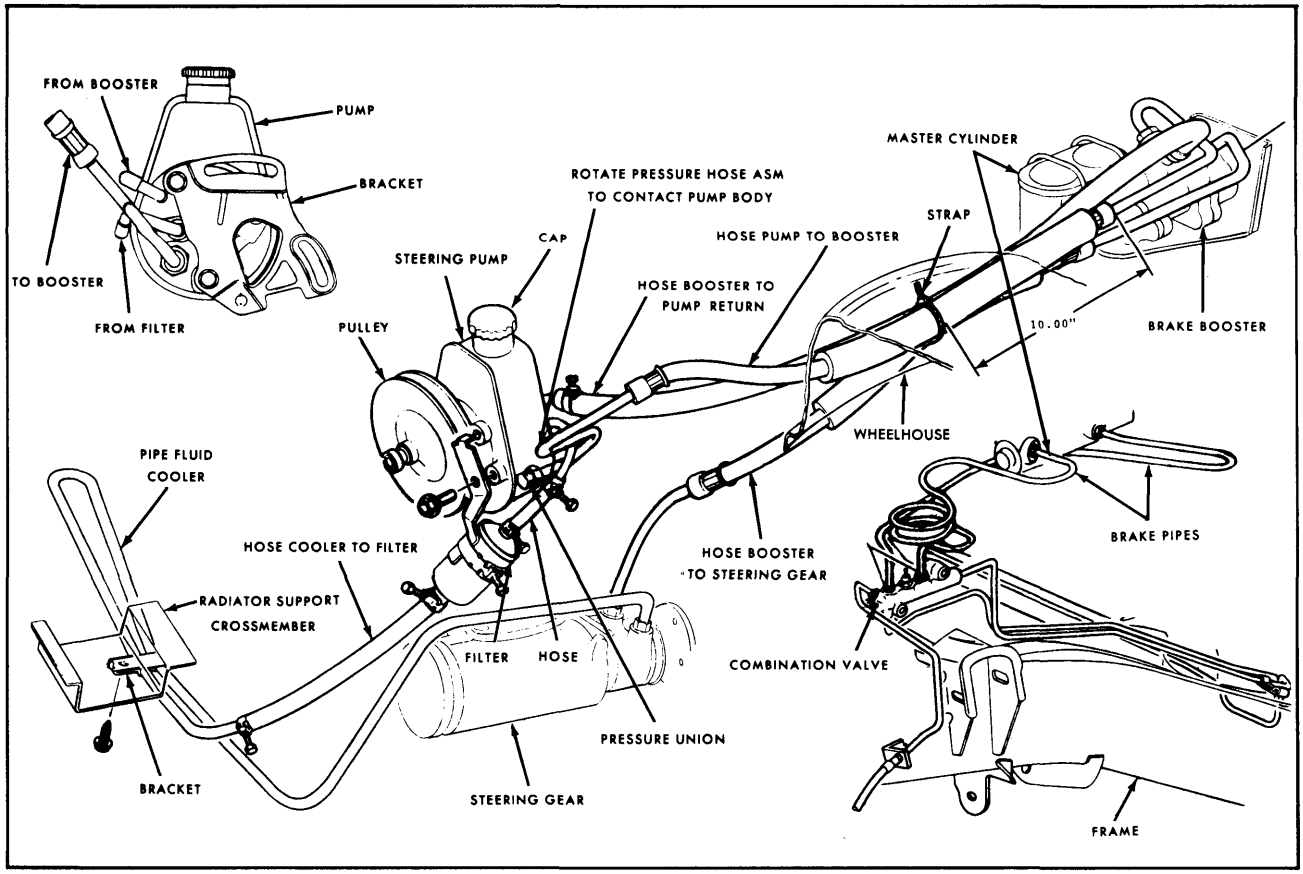


Fig. 5-69 Hydro-Boost Brake System

HYDRO-BOOST
GENERAL DESCRIPTION

"Hydro-boost" is a hydraulically operated power brake booster. It is installed on Eldorados, Limousines and the Commercial Chassis, Fig. 5-69.

The hydraulic brake booster consists of an open center spool valve and a hydraulic cylinder combined into a single housing. The power steering pump provides the hydraulic fluid pressure to operate both the power brake booster and power steering gear.

A dual master cylinder is bolted to the brake booster and is operated by a push rod projecting from the booster cylinder bore.

The Hydro-boost also has a reserve (accumulator) system which stores sufficient fluid under pressure to provide at least (3) power assisted brake applications in the event that the power steering pump fluid flow is interrupted.

DIAGNOSIS

43. Prior to performing the Booster Function Tests, or the Accumulator Leakdown Test, the following preliminary checks must be made:

CAUTION: Power steering fluid and brake fluid cannot be mixed. If brake seals contact steering fluid or steering seals contact brake fluid, seal damage will result.

1. Check all power steering and brake lines and connections for leaks and/or restrictions.
2. Check and fill brake master cylinder with brake fluid.
3. Check and fill power steering pump reservoir with power steering fluid. Insure fluid is not aerated (air mixed with fluid).
4. Check power steering pump belt for tension and/or damage. Adjust if necessary.
5. Check engine idle speed and adjust if necessary.
6. Check steering pump pressure. See Section 9, Note 2.

44. Seal Leak Diagnosis

1. Input Rod Seal: A damaged seal will show up as a fluid leak onto the drip pan from the mounting bracket vent hole. The booster must be removed from the car and replaced.

BACK TO INDEX

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HYDRO-BOOST DIAGNOSIS

CONDITION	CAUSE	CORRECTION
Excessive Brake Pedal Effort	Loose or broken power steering pump belt.	Tighten or replace the belt.
	No fluid in power steering reservoir.	Fill reservoir and check for external leaks.
	Leaks in power steering, booster or accumulator hoses.	Replace faulty parts.
	Leaks at tube fittings, power steering, booster or accumulator connections.	Tighten fittings or replace tube seats, if faulty.
	External leakage at accumulator.	Replace "O" ring and retainer.
	Faulty booster piston seal causing leakage at booster flange vent.	Overhaul with new seal kit.
	Faulty booster input rod seal with leakage at input rod end.	Replace booster.
	Faulty booster cover seal with leakage between housing and cover.	Overhaul with new seal kit.
	Faulty booster spool plug seal.	Overhaul with spool plug seal kit.
Slow Brake Pedal Return	Excessive seal friction in booster.	Overhaul with new seal kit.
	Faulty spool action.	Flush steering system while pumping brake pedal.
	Broken piston return spring.	Replace spring.
	Restriction in return line from booster to pump reservoir.	Replace line.
	Broken spool return spring.	Replace spring.
Grabby Brakes	Broken spool return spring.	Replace spring.
	Faulty spool action caused by contamination in system.	Flush steering system while pumping brake pedal.
Booster Chatters – Pedal Vibrates	Power steering pump belt slips.	Tighten belt.
	Low fluid level in power steering pump reservoir.	Fill reservoir and check for external leaks.
	Faulty spool operation caused by contamination in system.	Flush steering system while pumping brake pedal.
Accumulator Leak Down – System does not hold charge	Contamination in steering hydro-boost system	Flush steering system while pumping brake pedal.
	Internal leakage in accumulator system	Overhaul unit using accumulator rebuild kit and seal kit.

BACK TO INDEX

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2. Power Piston Seal: Power piston seal damage will be noticed by fluid leaking out at the common master cylinder-brake booster vent and a possible reduction in power assist. The booster must be removed from the car and disassembled. The piston should be checked for any scratches that may be the cause of the leak. If scratches are present, then the power piston must be replaced. If no excessive scratches are present, then the booster Seal Kit can be used to replace the appropriate seals.

3. Housing Seal: If the housing seal is damaged, fluid will leak out from between the two housings onto the drip pan. The booster must be removed from the car and disassembled. The booster Seal Kit should be used to replace the housing and power piston seals.

4. Spool Valve Plug 'O' Ring Seal: Damage to this seal will be noticed by fluid leaking out past the plug. The booster need not be removed from the car. The master cylinder should be disconnected from the booster. Insert a small punch into the hole in the front housing and remove the retaining ring from the bore, Fig. 5-70. Using pliers, withdraw the plug from the bore. Remove the 'O' ring from the plug and replace with a new one. Clean any dirt or rust from the plug bore using fresh power steering fluid. Insure that no dirt or rust is introduced into the booster. Push the end plug back into the bore and secure with a new retaining ring.

5. Accumulator Piston Seals, Plunger Seat Seal Ring, and Check Valve Seal Ring: Any damage to these seals would cause internal leakage. This would cause the accumulator to leak down resulting in the loss of reserve stopping. Seals must be replaced with their assemblies.

6. Accumulator 'O' Ring Seal: Damage to this seal will result in fluid leakage past the accumulator spring cap. The seal can be replaced while the booster is installed on the car. The strap securing the drip pan to the booster must be removed and a catch basin placed under the booster to catch the fluid when the accumulator spring cap is removed.

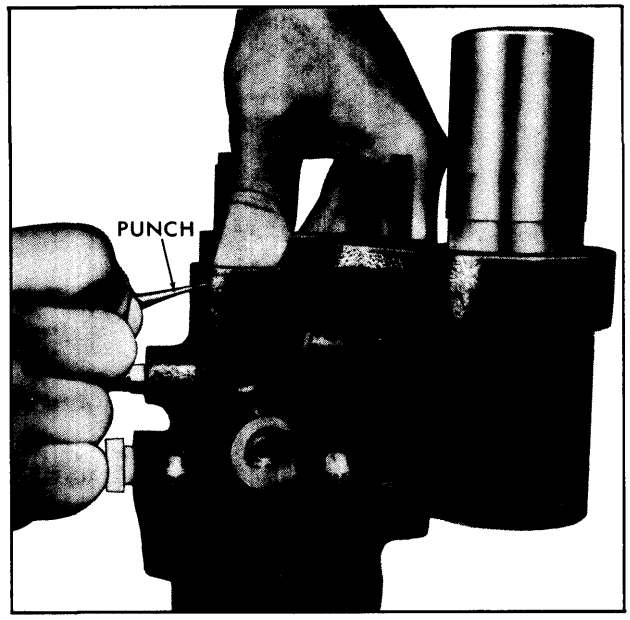


Fig. 5-70 Removing Spool Plug Retainer

CAUTION: Before removing the spring cap the brake pedal must be pumped 4-5 times to deplete accumulator pressure.

Remove the accumulator cap using a large 'C' clamp and small punch as outlined in Note 47a. Caution must be taken to insure that no dirt or rust are introduced into the booster when the cap is removed. Replace the 'O' ring and reassemble the accumulator cap to the booster using a new retaining ring.

SERVICE INFORMATION

45. Hydraulic Power Brake Booster

a. Removal

CAUTION: Power steering fluid and brake fluid cannot be mixed. If brake seals contact steering fluid or steering seals contact brake fluid, seal damage will result.

1. Pump brake pedal 4 or 5 times with engine stopped to empty accumulator of fluid which is under pressure.
2. Remove two nuts securing master cylinder to booster and carefully move master cylinder away from booster, with brake lines attached.
3. Remove three hydraulic lines from brake booster. Plug and cap all ports and lines to prevent loss of fluid and entrance of dirt.
4. Remove retainer and washer that secures booster pedal rod to brake pedal arm.
5. Remove four nuts that secure booster to firewall. (NOTE: Pedal rod should never be pried off pedal arm as this could damage booster.)
6. Working under hood, loosen booster from firewall and move booster pedal rod inboard until it disconnects from brake pedal arm. Remove spring washer from brake pedal arm.
7. Remove booster from car.

b. Installation

1. Install spring washer on brake pedal arm and position brake booster to firewall with booster pedal rod extending through firewall. Install rod on brake pedal arm.
2. Secure booster to firewall and brake pedal bracket with four nuts. Torque nuts to 15 foot-pounds.
3. Install retainer and washer securing booster pedal rod to brake pedal arm.
4. Position master cylinder to booster and secure with two nuts. Torque nuts to 20 foot-pounds.
5. Unplug and uncap all lines and ports and install three hydraulic lines to brake booster. Torque to 30 foot-pounds.
6. Bleed steering system as outlined in note 49.

46. Hydraulic Brake Booster Overhaul

If work is to be done on accumulator piston, it must be performed first, as outlined in note 47.

BACK TO INDEX

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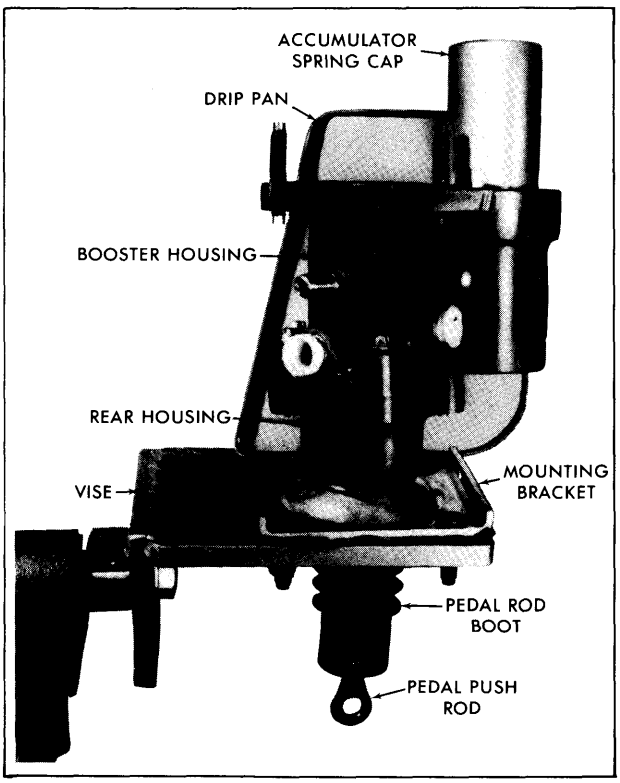


Fig. 5-71 Booster Secured in Vise

a. Disassembly

CAUTION: Power steering fluid and brake fluid cannot be mixed. If brake seals contact steering fluid or steering seals contact brake fluid, seal damage will result.

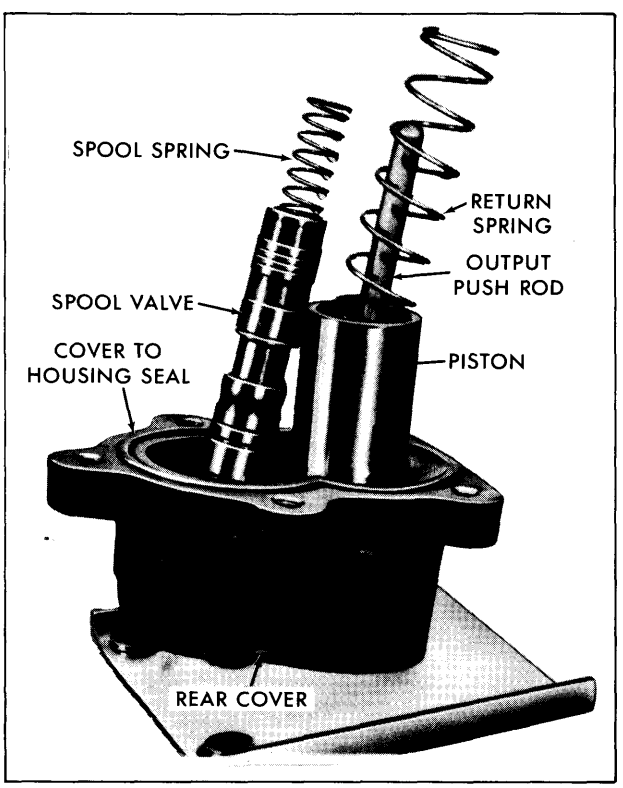


Fig. 5-72 Booster Housing Removed

1. Remove booster from car as outlined in Note 45a.
2. Secure booster mounting bracket in vise with pedal rod pointing down, Fig. 5-71.
3. Pump pedal rod 4 or 5 times to insure that accumulator is depleted.
4. Cut strap securing accumulator cap to drip pan.
5. Using Socket J-25085 loosen five torx head bolts securing front housing to rear cover.

(NOTE: Rear cover refers to part of booster that is attached to mounting bracket.)

6. While holding front housing, remove torx head bolts.

(NOTE: Have pan ready to catch and discard leaking fluid.)

7. Carefully lift off front housing leaving spool valve and power piston assembly attached to rear cover, Fig. 5-72.

CAUTION: Care should be taken when handling the front housing as the accumulator contains a high rate spring in compression.

8. Remove output rod and piston return spring from power piston assembly and spool valve spring from valve. Remove output rod retainer assembly from front housing.
9. Remove spool valve from power piston assembly by rotating it out of lever arm. Compare spool valve condition to Fig. 5-73. Valve must be replaced or may be reinstalled as indicated. Remove large "figure eight" seal from groove in cover and discard seal.
10. Remove power piston seal from bore and discard seal.
11. Inspect power piston. If scratches, big enough to be felt with a fingernail, are present then piston must be replaced.
12. Using diagonal cutters snip off end of connecting pin, Fig. 5-74.
13. Push pin out using small punch and remove piston.
14. Flush housing assemblies with clean power steering fluid.

b. Assembly

1. If piston was removed, slide connecting bracket on new piston into small yoke in lever and push new pin through hole.
2. Using Tool J-26410, mushroom end of pin, Fig. 5-75. Insure that lever movement is free with no binding.
3. Grasp rear cover and drip pan assembly (with power piston and pedal rod) by mounting bracket in a vise. Housing seal groove should face up.
4. Install new housing seal in groove in rear cover.
5. Install new power piston seal in front housing, Fig. 5-76.
6. Insert spool valve spring and spool valve assembly into bore in front housing, Fig. 5-77.
7. Pull up on power piston and extend lever to accept sleeve on spool valve.
8. While holding lever extended with one hand, bring front housing with spool valve assembly directly

BACK TO INDEX

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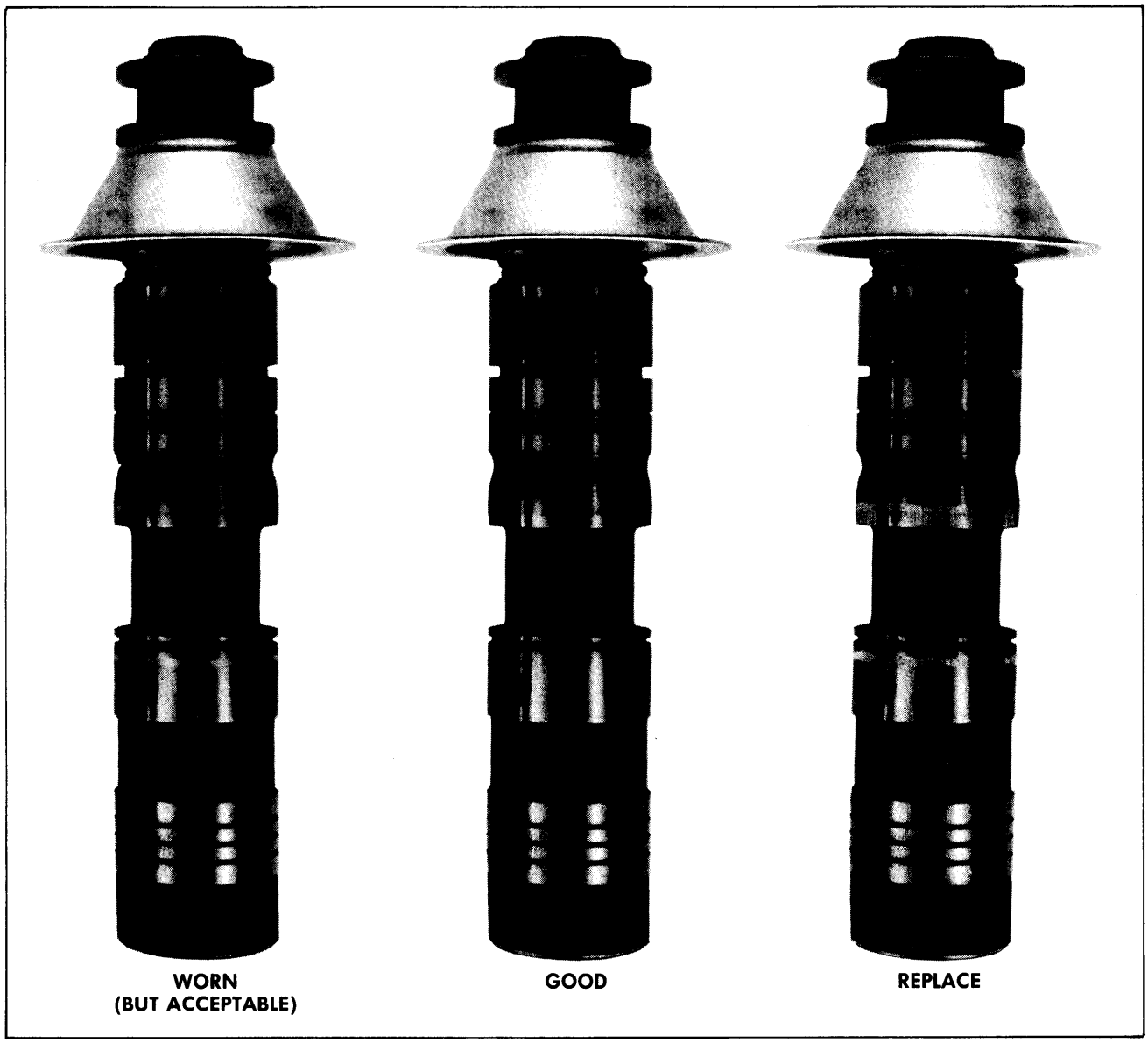


Fig. 5-73 Spool Valve Condition

over rear cover and slide lever pins into slot in sleeve, Fig. 5-78.

9. Center power piston in bore and begin to lower front housing down onto rear cover. Before power piston contacts power piston seal, push seal protector tool, J-25053 through piston bore until it seats in power piston, Fig. 5-79.

10. Push two housings together and remove tool J-25053.

11. Replace five Torx bolts and torque to 20 foot-pounds.

12. Install output rod, spring and new spring retainer.

13. Secure new output rod retainer using mechanics deep 7/8" socket and tap in place with a hammer, Fig. 5-80.

14. Mount new decal on accumulator spring cap and install new strap to support drip pan.

15. Remove booster from vise and install on car as outlined in Note 45b.

47. Accumulator Overhaul

a. Disassembly

CAUTION: Power steering fluid and brake fluid cannot be mixed. If brake seals contact steering fluid or steering seals contact brake fluid, seal damage will result.

1. Remove booster from car as outlined in Note 45a.

2. Secure booster mounting bracket in vise with pedal rod pointing down.

3. Pump pedal rod 4 or 5 times to insure that accumulator is depleted.

4. Using a large "C" clamp (12" minimum), depress accumulator spring cap, Fig. 5-81, and insert a punch into small hole in front housing, unseating retainer ring. Remove the retaining ring, Fig. 5-82.

(NOTE: Tool J-22222-2 can be placed over spring cap before depressing to steady cap.)

BACK TO INDEX

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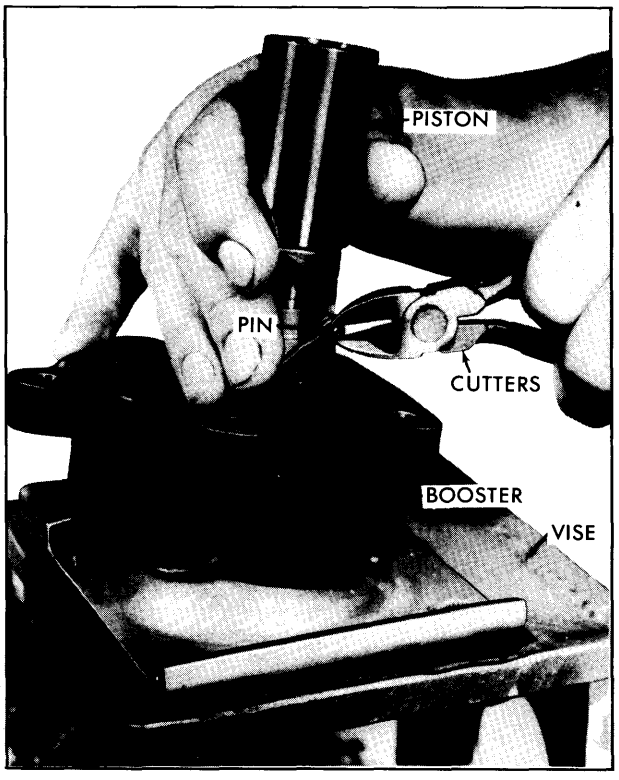


Fig. 5-74 Cutting Piston Pin

5. Slowly back clamp off until spring tension on cap is released. Remove clamp, spring cap, and accumulator spring.

CAUTION: Extreme care must be taken when removing accumulator spring cap as it contains a high rate compressed spring.

6. If shop air is available, plug gear and return ports. Holding a hand over accumulator piston, pressurize booster with shop air through inlet port, Fig. 5-83. Piston will back out of housing bore. If shop air is not available, use a hook made from a stiff piece of wire. Engage the hook in the piston fluid inlet hole. Using a suitable tool for leverage, wrap wire around tool and pry against housing to remove piston from bore and discard piston.

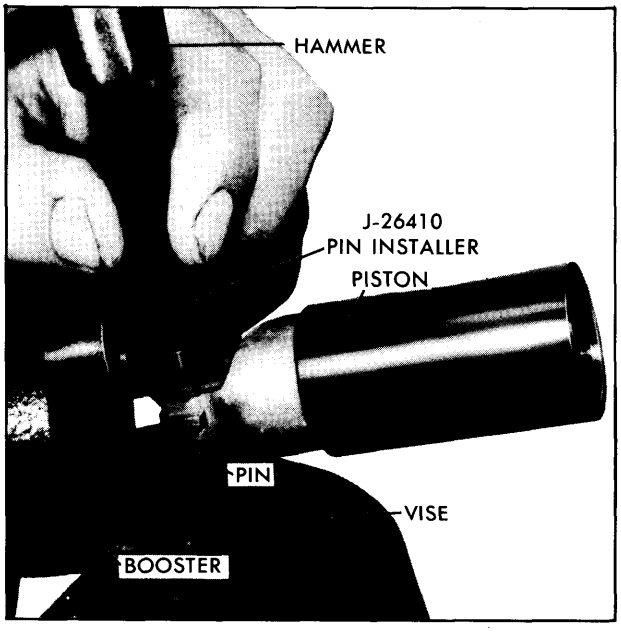


Fig. 5-75 Staking Piston Pin



Fig. 5-76 Installing Piston Seal

7. Disassemble booster as outlined in Note 46a.

8. Remove accumulator plunger seat and guide assembly, Fig. 5-84.

9. Using a small diameter wire hook, remove spacer-charging orifice and ball assembly and discard, Fig. 5-85.

b. Assembly

1. Using clean power steering fluid as a lubricant, lower new spacer-charging orifice and ball assembly into accumulator valve bore in front housing, Fig. 5-85.

2. Using clean power steering fluid as a lubricant, mount new "O" ring seal onto new accumulator plunger seat and guide assembly and insert into accumulator valve bore, Fig. 5-86.

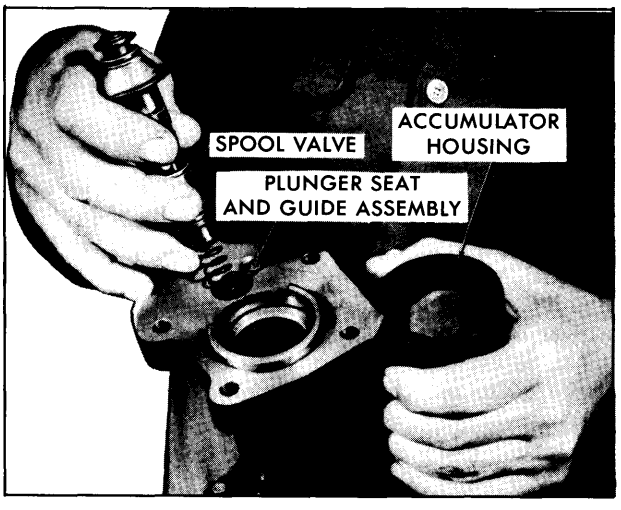


Fig. 5-77 Installing Spool Valve in Housing

BACK TO INDEX

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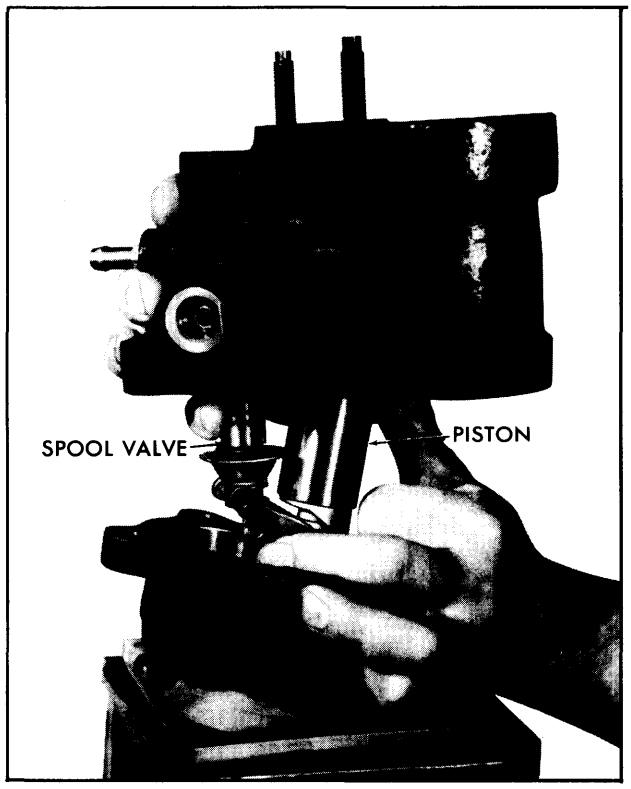


Fig. 5-78 Engaging Lever Pins in Spool Valve Sleeve

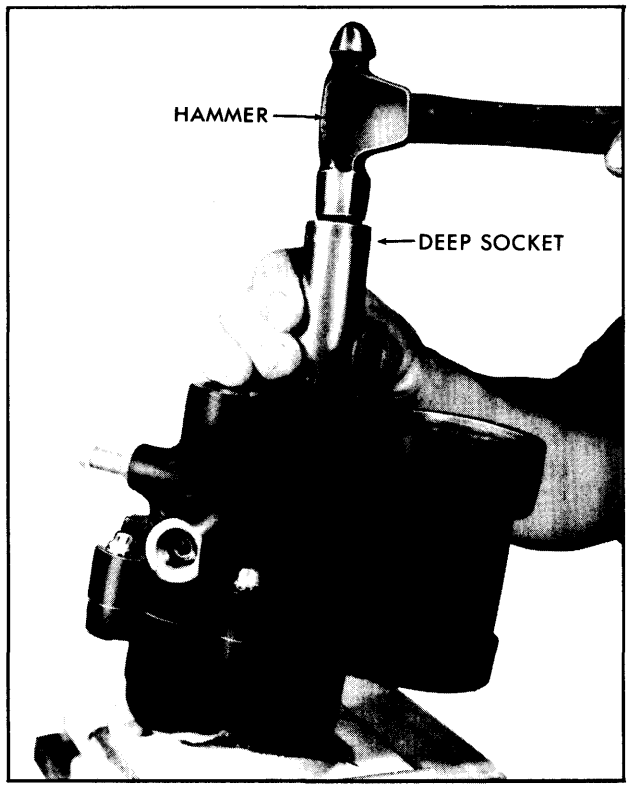


Fig. 5-80 Securing Output Rod Spring Retainer

3. Assemble booster as outlined in Note 46b.

4. Insert new accumulator piston assembly in front housing bore. If piston cannot be inserted all the way, push pedal rod in to relieve trapped air pressure below piston.

(NOTE: Care must be taken not to disturb relief valve while installing accumulator spring in piston.)

5. Mount new "O" ring (1.987 ID) to accumulator cap. Position cap and retainer under tool J-22222-2 and using large "C" clamp, depress accumulator cap down

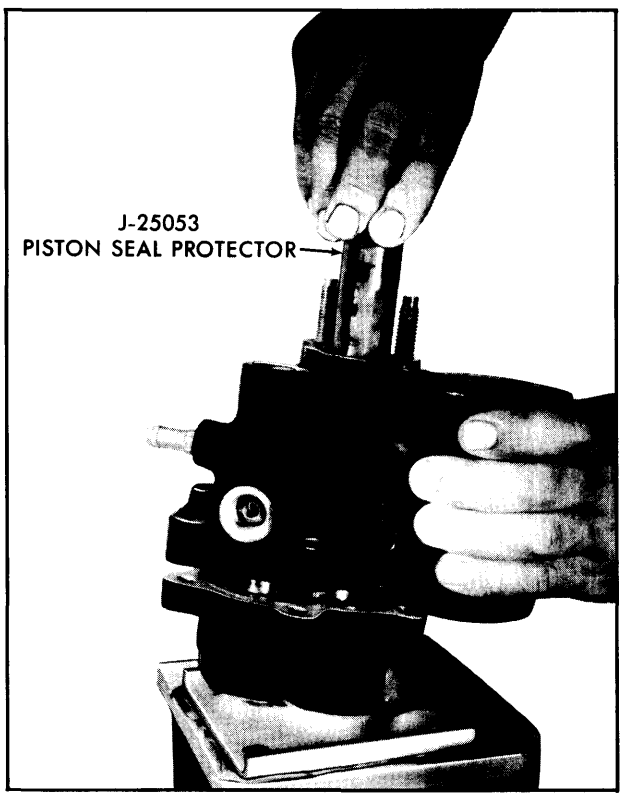


Fig. 5-79 Installing Piston Seal Protector

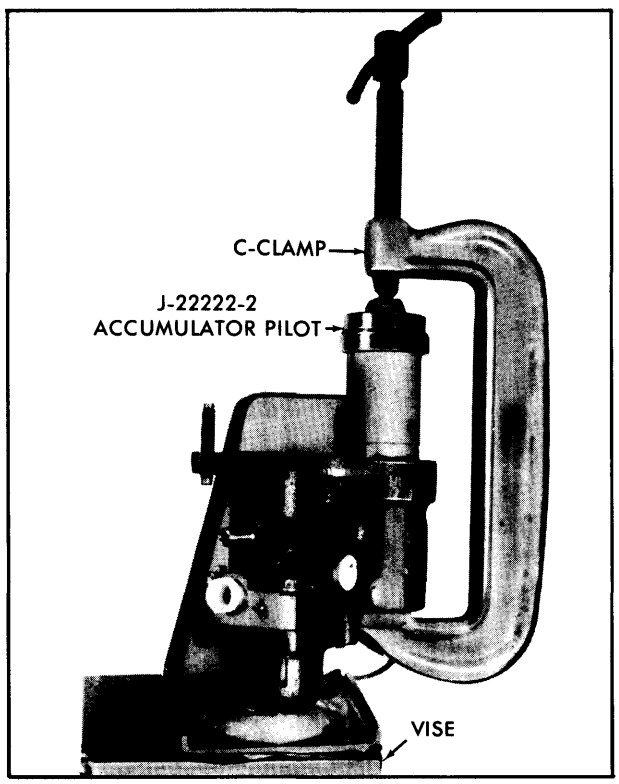


Fig. 5-81 Depressing Accumulator Spring Cap

BACK TO INDEX

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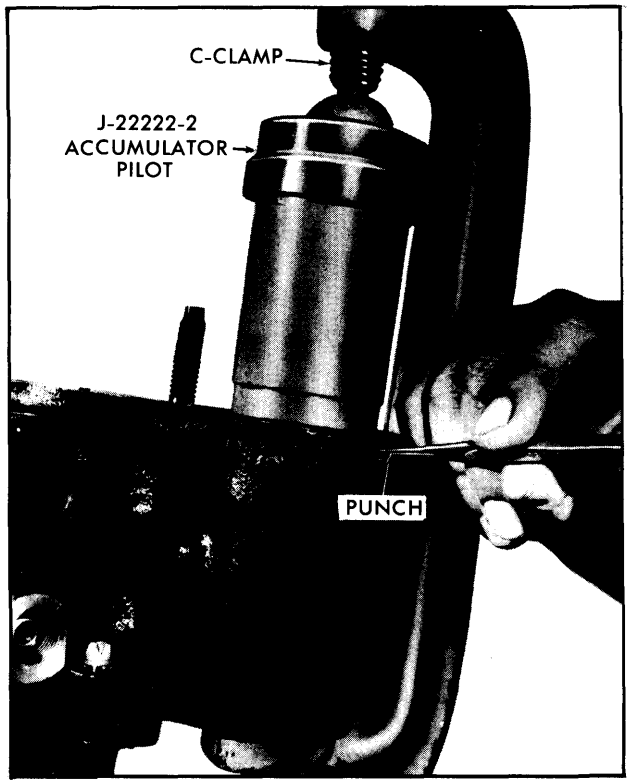


Fig. 5-82 Unseating Retaining Ring

over spring into bore in front housing. Secure cap with a new retainer ring and remove "C" clamp.

6. Install new strap to support drip pan to accumulator spring cap.

7. Remove booster from vise and install on car as outlined in Note 45b.

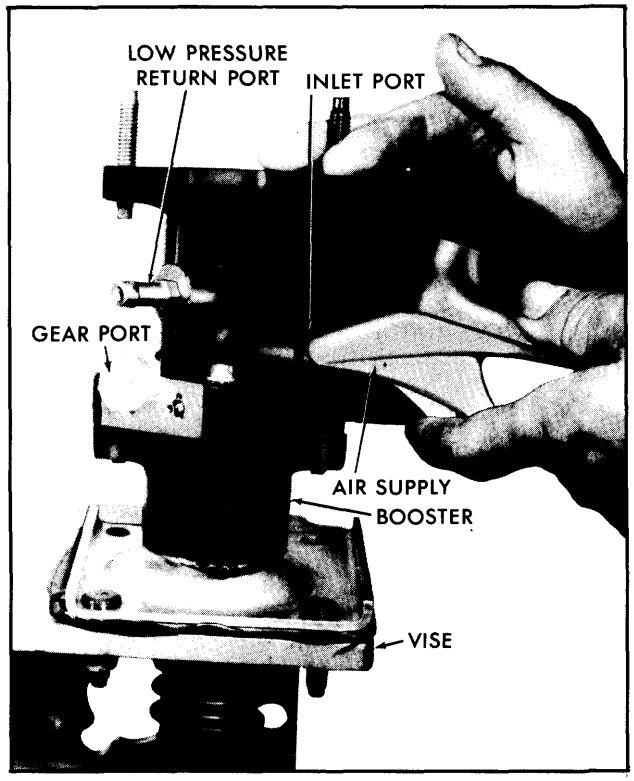


Fig. 5-83 Removing Accumulator Piston

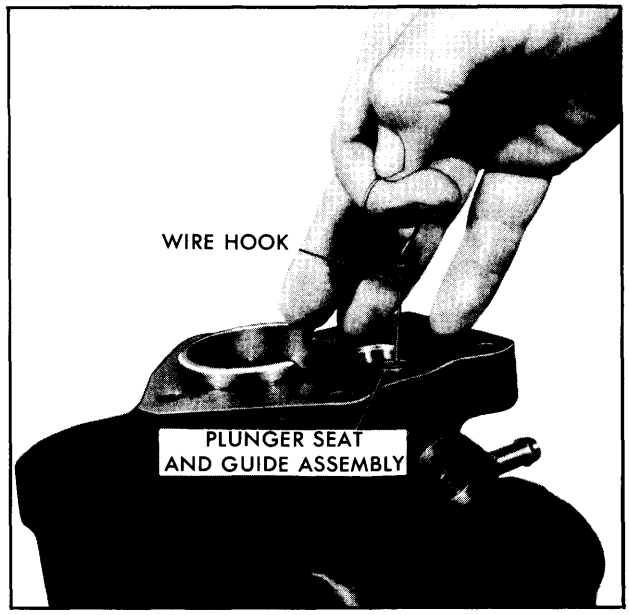


Fig. 5-84 Removing Plunger Seat and Guide

48. Trouble Shooting and Testing

The Hydro-Boost differs from vacuum brake boosters not only in the source of power (hydraulic versus vacuum) but in the fact that it is also a part of another major sub-system of the car – the power steering system. Therefore, problems or malfunctions in the steering system may affect the operation of the booster, just as a problem in the booster may affect the steering system. The following noises are associated with the Hydro-boost system and may or may not be cause for customer complaint. Some are normal and for the most part temporary in nature. Others may be a sign of excessive wear or the presence of air in either the booster or the steering system.

1. Moan or low frequency hum usually accompanied by a vibration in the pedal and/or steering

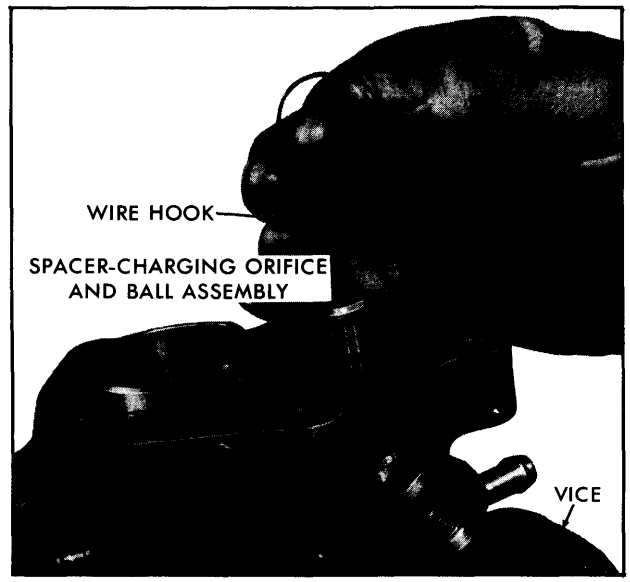


Fig. 5-85 Removing Spacer Charging Orifice

BACK TO INDEX

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column may be observed during parking maneuvers or other very low speed maneuvers. This may be caused by a low fluid level in the power steering pump or by air in the power steering fluid due to holding the pump at relief pressure (steering wheel held all the way in one direction) for an excessive amount of time (more than 5 seconds). Check the fluid level and fill to mark. System must sit for 1 hour with the cap removed to remove the air. If the condition persists, this may be a sign of excessive pump wear and the pump should be checked following the shop manual procedure.

2. At or near power runout, (brake pedal near fully depressed position) a high speed fluid noise (faucet type) may be heard. This is a normal condition and will not be heard except in emergency braking conditions.

3. Whenever the accumulator pressure is used, a slight hiss may be noticed. It is the sound of the hydraulic fluid escaping through the accumulator valve, and is completely normal.

4. After the accumulator has been emptied, and the engine is started again, another hissing sound may be heard during the first brake application or the first steering maneuver. This is caused by the fluid rushing through the accumulator charging orifice. It is normal and will only be heard once after the accumulator is emptied. However, if this sound continues, even though no apparent accumulator pressure assist was made, it could be an indication that the accumulator is not holding pressure and should be checked using the procedure for Accumulator Leakdown Test.

5. After bleeding, a "gulping" sound may be present during brake applications as noted in the bleeding instructions.

49. Hydro-Boost Bleeding Procedure

Whenever the booster is removed and reinstalled, the steering system should be bled as outlined below:

CAUTION: Power steering fluid and brake fluid cannot be mixed. If brake seals contact steering fluid or steering seals contact brake fluid, seal damage will result.

1. Install power steering fluid in steering pump until the level in the pump is at the base of the pump reservoir neck.
2. Disconnect the battery lead from the H.E.I. distributor to prevent engine from starting.
3. Raise front of car and turn wheels all the way to the left.
4. Crank engine for a few seconds.
5. Check fluid level and add fluid to "Add" mark on dipstick, if necessary.
6. Lower car, connect battery lead, and start the engine. Check fluid level and add fluid to "Add" mark on dipstick, if necessary.
7. With the engine running, turn wheels from side to side to bleed the air from the system. Insure that the fluid level remains above the internal pump casting.
8. The above procedure should remove all air from the steering/Hydro-boost system. If the fluid is foaming after bleeding, turn the engine off and let the system sit for one hour and repeat Step 7.

The Hydro-boost is basically self-bleeding, and the above procedure will normally bleed the air from the booster unit. However, occasionally air will be trapped in the top of the rear cover. When this happens, the booster may emit a "gulping" noise when the brake is applied. Normally, this condition will disappear after running the engine for a few minutes while lightly pumping the brake. After the "gulping" sound disappears, the pump fluid level should be checked and fluid added if necessary.

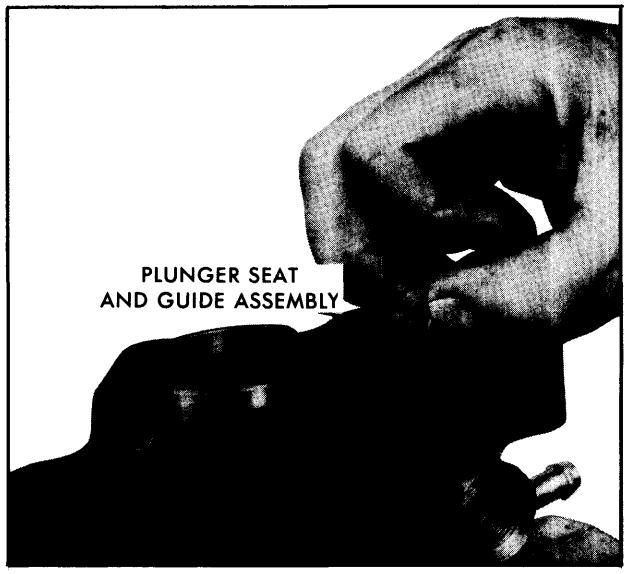


Fig. 5-86 Installing Plunger Seat and Guide

50. Booster Functional Test

With the engine off apply the brake pedal several times until the accumulator is completely depleted. Depress the service brake pedal (approximately 40 pounds pedal force) and start the engine. The pedal should fall and then push back against driver's foot.

51. Accumulator Leakdown Test

Start engine and charge accumulator by either applying the service brake (approximately 100 pounds pedal force) or by turning the steering wheel from stop to stop. Turn off engine and let car sit for one hour. After one hour there should be three power assisted applies with engine stopped.

BACK TO INDEX

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SPECIFICATIONS

Item	Eldorado Series Cars
Swept Braking Area (in square inches)	
Front	224
Rear	224
Lining Area (in square inches)	
Front	42
Rear	42
Wheel Cylinder Bore	
Front	2-15/16"
Rear	2 1/2"
Lateral Run-Out of Rotor on Hub (Maximum)	008"
Flatness and Parallelism Between Frictional Surfaces of Rotor	0005"
Minimum Rotor Thickness	1.190"
Lining Size (length, width, thickness in inches)	
Front and Rear	Inner Shoe 5.4 x 1.93 x .43
	Outer Shoe 5.4 x 1.93 x .41
Lining to Shoe Attachment Method Rear	Steel Eyelets
Front	Steel Eyelets
Brake Combination Valve	
Rear Brake Proportioning Pressure	41% above 350 psi
Failure Warning Differential Pressure	100-300 psi

BACK TO INDEX

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TORQUE SPECIFICATIONS—ELDORADO ONLY

Material Number	Application	Size	Foot-Pounds
280M	Bearing Retainer/Splash Shield to Knuckle	3/8-16	30
286M	*Brake Backing Plate to Rear Axle Housing	3/8-24	40
301M	Upper Spherical Joint Nut	1/2-20	60
280M	Rear Caliper Inlet Bolt and Block to Caliper	7/16-20	30 max.
Special	*Caliper Mounting Bolts	Special	30
Special	Parking Brake Cable Lever to Caliper Actuator Screw	7/16-20	25
Special	Front Caliper Inlet Hose	3/8-24	30
Special	Rear Caliper Brake Line Tube Nut	3/8-24	20 max.
Special	Rear Brake Line to Rear Axle Junction Fitting	Special	20
Special	Rear Brake Line to Rear Brake Hose	7/16-24	20 max.
286M	Hydraulic Brake Booster to Firewall	3/8-16	15
Special	Hydraulic Lines to Booster	5/8-18	30
Special	Hydraulic Brake Booster Front Housing to Rear Cover Screw	Special	20
286M	Wheel Mounting Nuts	1/2-20	130

(NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings and steel classifications.)

**CAUTION: This fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.*

BACK TO INDEX

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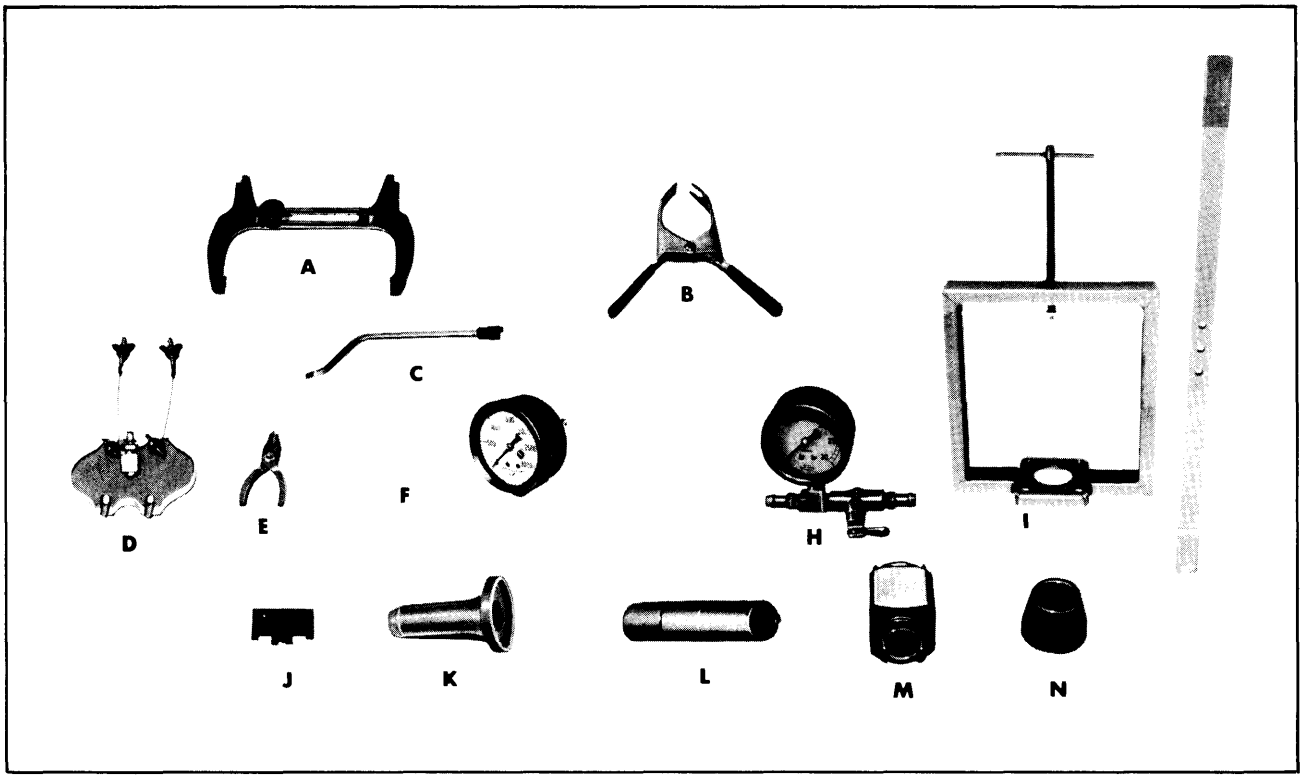


Fig. 5-87 Special Tools – Brakes

Key	Tool No.	Name	Key	Tool No.	Name
A	J-21177	Brake Adjusting Caliper	H	J-23108	Leak Testing Adapter
B	J-23770	Brake Combination Valve Bleeder	I	J-22884	Power Unit Holding and Separating Fixture
C	J-8049	Brake Spring Remover and Installer	J	J-22647	Push Rod Gage
			K	J-22904	Boot Installer
D	J-22484-1	Brake Bleeder Adapter	L	J-23175	Control Valve Retainer Installer
	J-22484-12	Bleeder Adapter Cover Cables			
E	J-4880	Snap Ring Pliers	M	J-23101	Power Piston Holding Fixture
F	J-24657	Brake Combination Valve Pressure Gage	N	J-23188	Seal Protector

BACK TO INDEX

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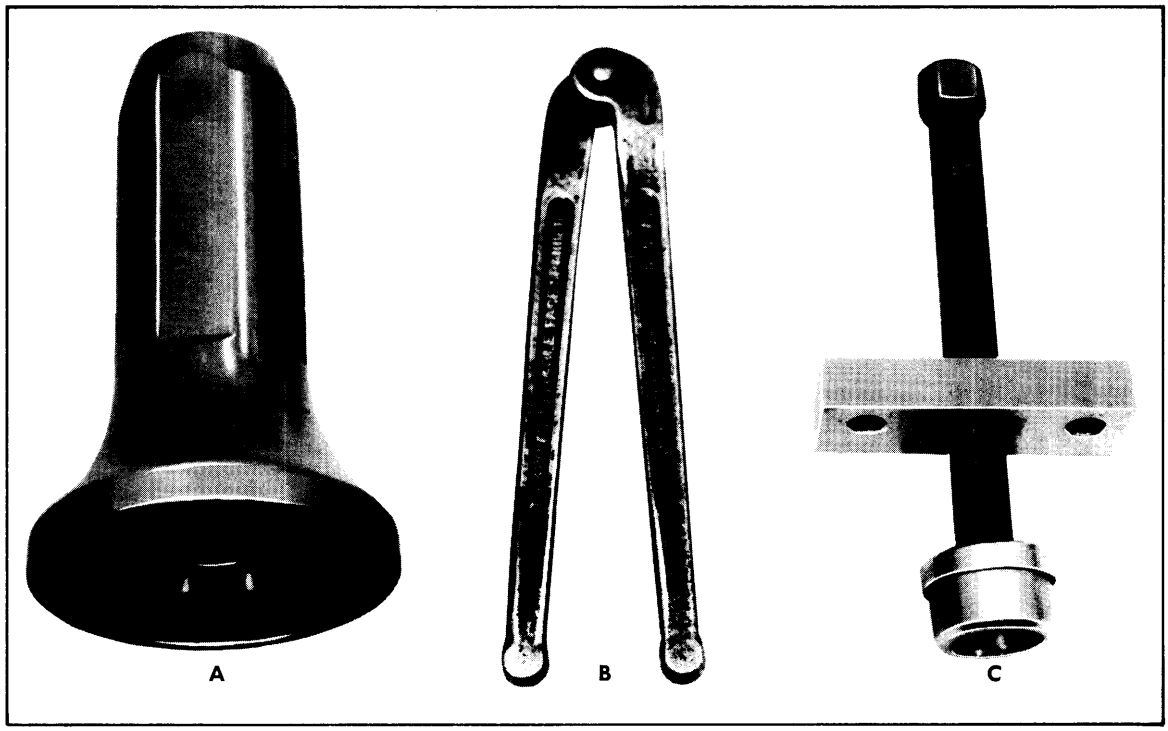


Fig. 5-88 Special Tools – Rear Disc Brakes

Key	Tool No.	Name	Key	Tool No.	Name
A	J-26296	Dust Boot Installer	C	J-23072	Rear Caliper Piston Installer
B	J-7624	Spanner Wrench			

BACK TO INDEX

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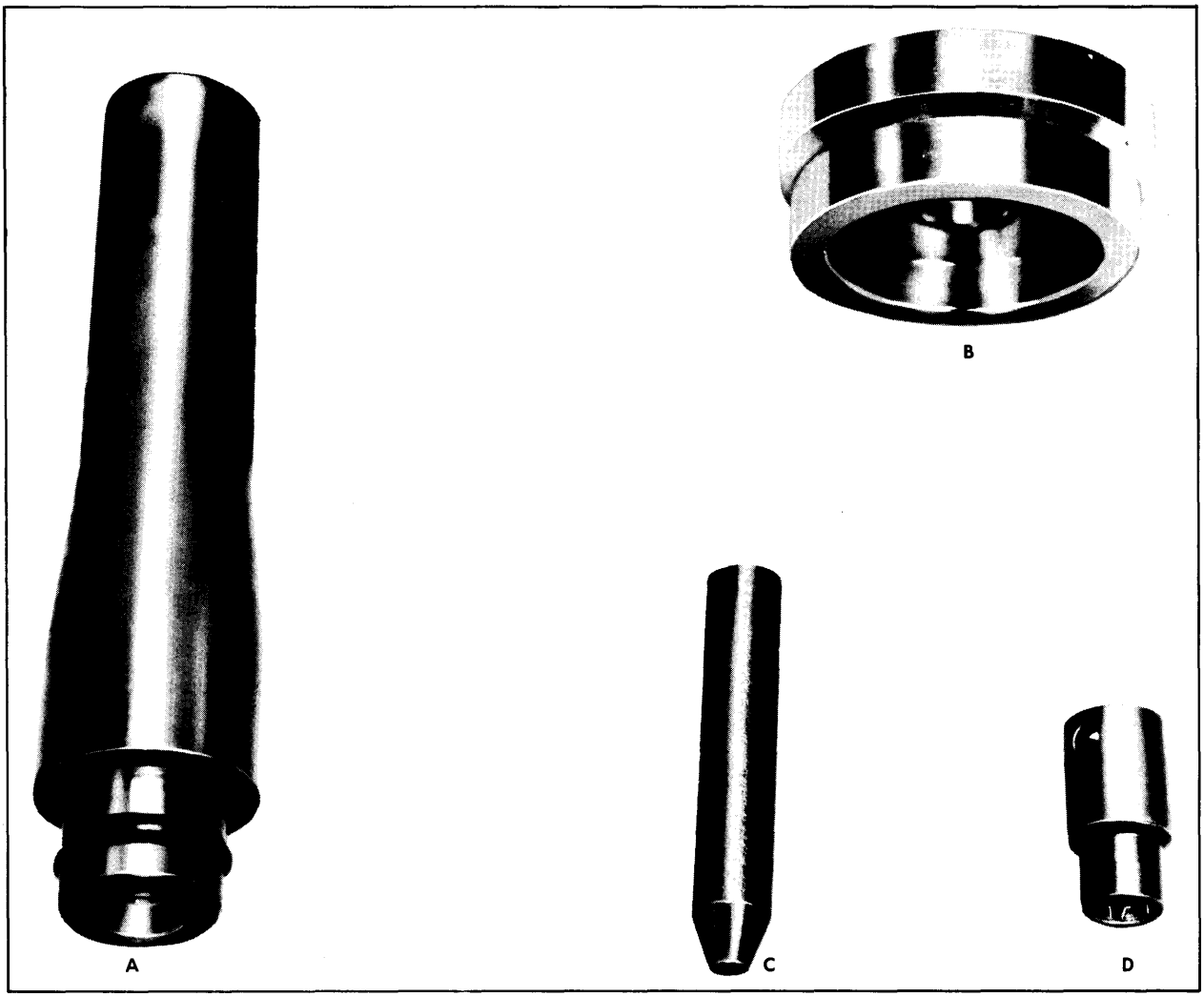


Fig. 5-89 Special Tools – Hydro-Boost

Key	Tool No.	Name	Key	Tool No.	Name
A	J-25053	Piston Seal Protector	C	J-26410	Boost Piston Pin Installer
B	J-22222-2	Accumulator Pilot	D	J-25085	Torx Socket

BACK TO INDEX

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TABLE OF CONTENTS

Subject	Page No.
Engine Cooling	6-2
Engine Electrical	6-16
Engine Fuel	6-53
Electronic Fuel Injection	6-86
Emission Control Systems	6-141
Engine Mechanical	6-156

BACK TO INDEX

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GENERAL DESCRIPTION

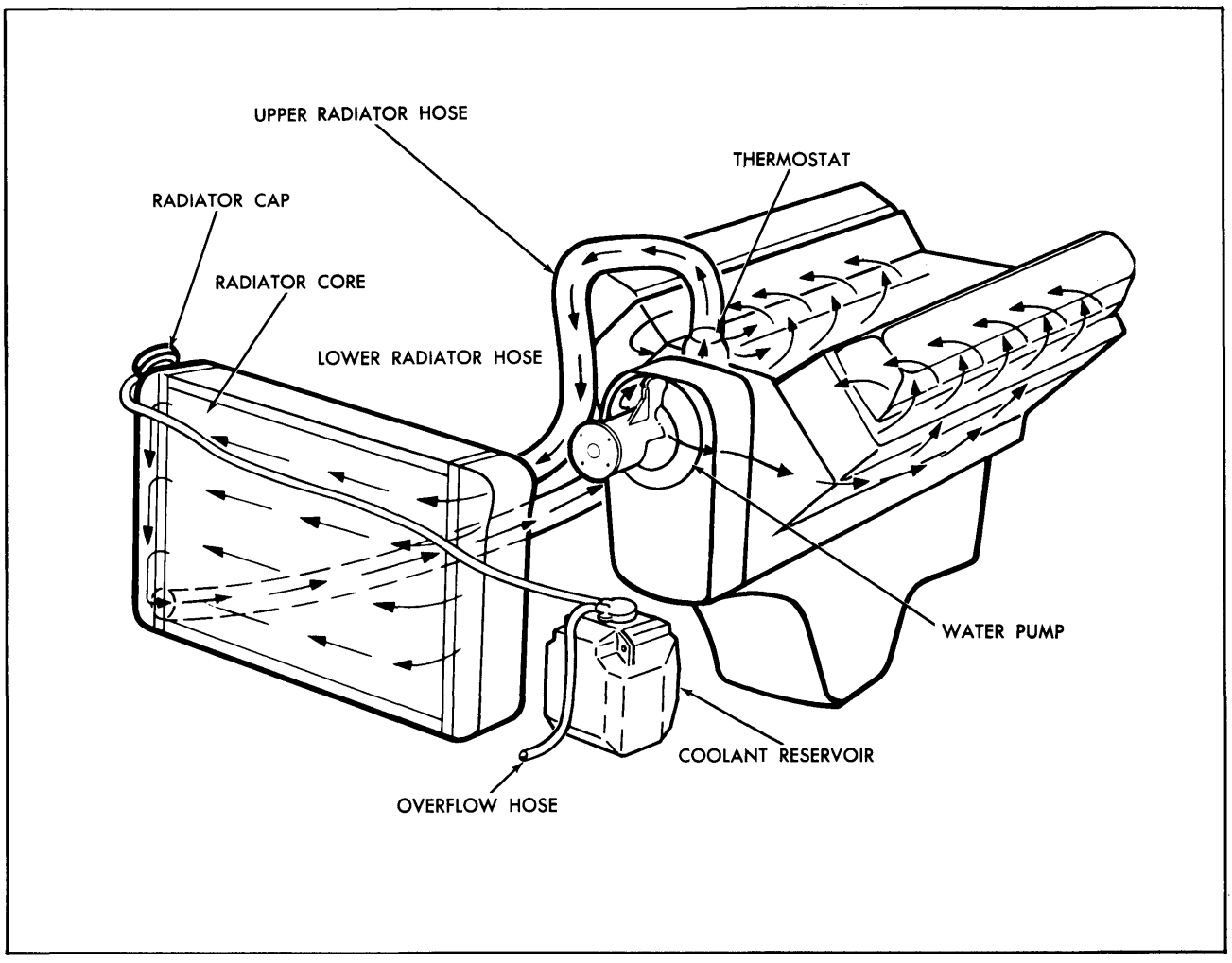


Fig. 6-1 Flow of Coolant

Cadillac uses a 3- tube radiator on all cars. The Limousine, Commercial Chassis and Heavy Duty (option V01) radiator is the same as other cars except for added copper in the core and a three plate transmission cooler in the outlet tank. All Cadillac radiators have a metal tab located near the bottom of the R.H. tank, engine side of radiator, giving the usage code. The following codes are used by Cadillac.

Standard Radiator Code AA
All except Heavy Duty Cooling and Limousine.

Heavy Duty Radiator Code AC
Heavy Duty Cooling and Limousine.

The cooling system is designed to be kept closed at all times. A coolant reservoir, Fig. 6-1, keeps the system full, indicates the need for additional coolant, and allows coolant to be added without removing the radiator cap.

A vented radiator cap is used, which allows the coolant to expand through the normally open vent valve in the center of the cap without building unnecessary pressure. The expanding coolant flows into the coolant reservoir. The vent valve closes when the temperature of the coolant nears the boiling point and pressure is needed to control boiling. The 15 pound pressure will not be reached until the system is working at maximum capacity.

Any air or vapor in the cooling system is forced into the coolant reservoir under the liquid level and exhausts through the overflow hose at the top of the reservoir. As the system cools, extra coolant in the reservoir is drawn back to the radiator through the vent valve. In this manner, the radiator is kept full at all times. The need for additional coolant can be detected by observing the level of coolant in the reservoir while the engine is at normal operating temperature.

The radiator cap, Fig. 6-2, should only be removed when draining and refilling the system or whenever it becomes necessary to add coolant because of lack of coolant in the reservoir, or when coolant has not been moving in and out of the reservoir.

BACK TO INDEX

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WARNING: IF THERE IS EVIDENCE OF STEAM, DO NOT OPEN HOOD UNTIL STEAM IS DISPERSED.



Fig. 6-2 Radiator Cap

Three different fan designs are used to meet the cooling requirements on Cadillac cars. All cars equipped with standard cooling system, except Eldorado, Limousine and Commercial, use a five blade flex fan with a 3 inch spacer. Eldorado's with standard cooling systems will use a seven blade flex fan with a 2 3/4 inch spacer. A high viscosity fluid clutch is used for heavy duty cooling and Commercial Chassis-Limousine applications.

In addition, the limousine and commercial chassis cars will also use a seven bladed flexible fan.

The fan clutch is serviced only as an assembly and is designed to reduce fan speed and noise as engine cooling needs become less (engine is cold) or to maintain fan speed should cooling needs increase (engine is warm).

The flex fan is designed so that the blades flatten out (decrease their pitch) at high engine speeds when additional air flow is not needed due to the "ram air" provided by vehicle motion.

The fan assemblies are illustrated in Fig. 6-3.

WARNING: IT IS ESSENTIAL THAT FAN ASSEMBLIES REMAIN IN PROPER BALANCE AND PROPER BALANCE CANNOT BE ASSURED ONCE A FAN ASSEMBLY HAS BEEN BENT OR DAMAGED. A FAN ASSEMBLY THAT IS NOT IN PROPER BALANCE COULD FAIL AND FLY APART DURING SUBSEQUENT USE CREATING AN EXTREMELY DANGEROUS CONDITION.

IF A FAN BLADE IS BENT OR DAMAGED IN ANY WAY, NO ATTEMPT SHOULD BE MADE TO REPAIR AND REUSE THE DAMAGED PART. A BENT OR DAMAGED FAN ASSEMBLY SHOULD ALWAYS BE REPLACED WITH A NEW FAN ASSEMBLY.

A double groove steel water pump pulley with a 1.24: 1 ratio is used on all cars equipped with A.I.R. Non A.I.R. cars use a single groove steel pulley with a 1.14: 1 ratio.

A water pump is mounted at the front of the engine. It is driven by a single "V" belt and may be serviced as described in Note 10.

Coolant is pumped to each bank of cylinders simultaneously, then through passages to the cylinder heads, through the thermostat housing at the top of the cylinder block to the left hand radiator tank. Radiator coolant flow is from the left hand tank through the core to the right hand tank, which is the source of coolant to the water pump inlet, Fig. 6-1.

When the thermostat is closed, coolant from the cylinder heads is pumped through a by-pass passage below the thermostat housing to the water pump and recirculated. When the engine is sufficiently warm, the thermostat opens and coolant flows to the inlet tank on the left side of the radiator, and is cooled as it flows across the horizontal core tubes to the outlet tank on the right side of the radiator, completing the cycle.

BACK TO INDEX

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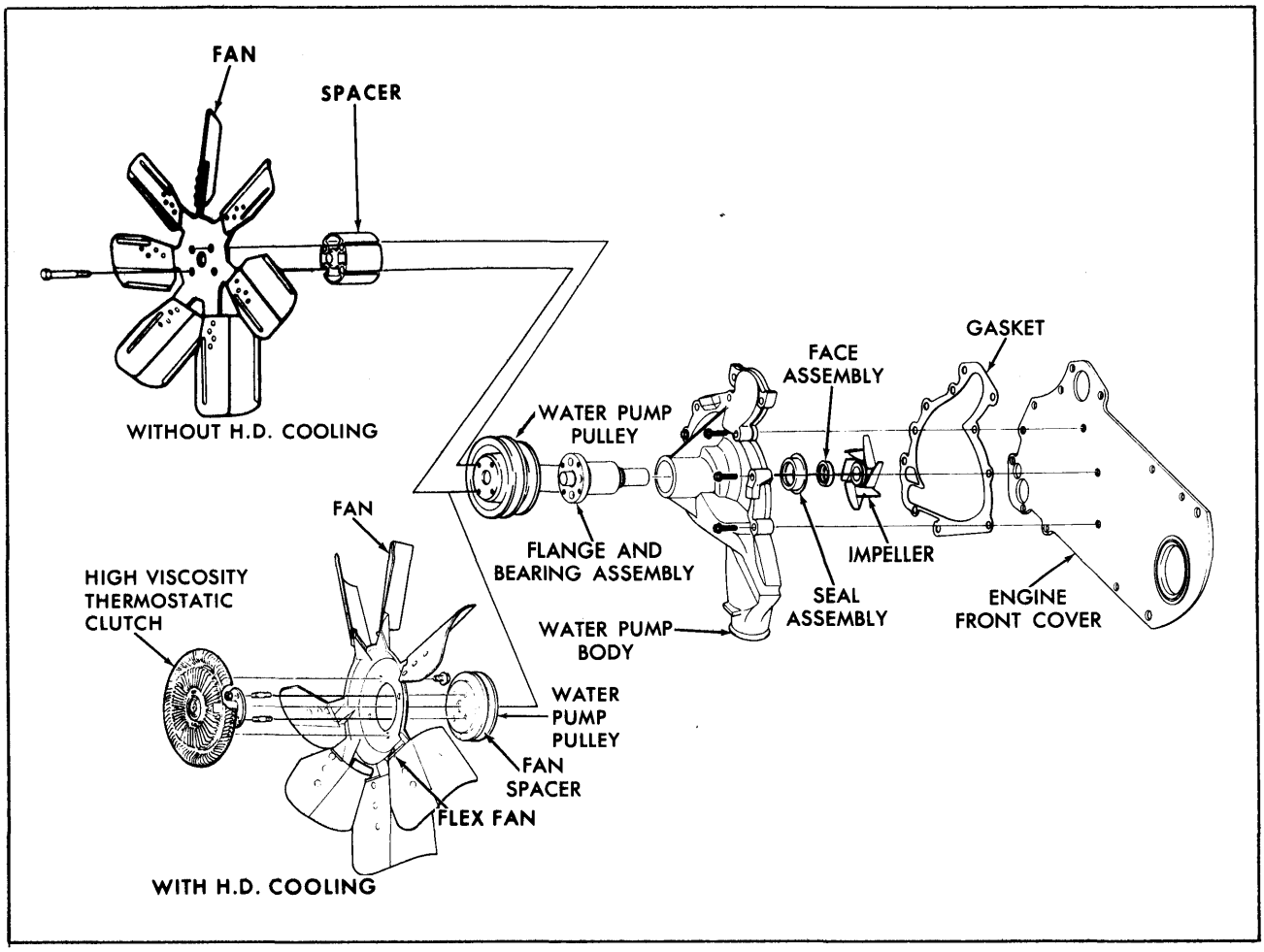


Fig. 6-3 Water Pump Disassembled

The coolant temperature tell-tale light is located in the warning light cluster at the top of the instrument panel, Fig. 12-19. The light reads "COOLANT TEMPERATURE" and glows amber whenever coolant temperature becomes excessive (260°F. (127°C) or higher). The light is activated by a temperature sensitive switch in the water passage directly below the air conditioning compressor. To check operation of the "COOLANT TEMPERATURE" tell-tale light, turn the ignition switch to the Start position. The light should glow. As soon as the switch is moved away from Start, the light should go out.

In addition to the water temperature warning light, an engine metal temperature warning light and buzzer system is used.

The second tell-tale light to the right of the "COOLANT TEMPERATURE" indicator (Fig. 12-19) is

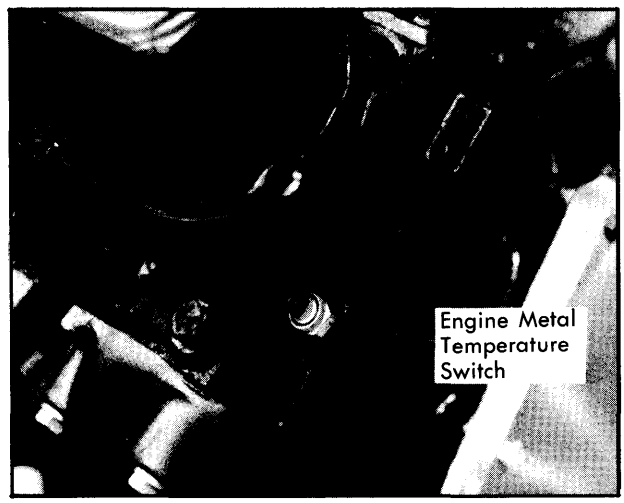


Fig. 6-4 Metal Temperature Switch

BACK TO INDEX

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COOLING SYSTEM DIAGNOSIS CHART

CONDITION	CAUSE	CORRECTION
Engine overheats (i.e., COOLANT and/or ENGINE TEMP lights come on and stay on, or coolant overflows from reservoir onto ground while engine is running).	Loss of coolant.	See "Loss of Coolant" condition below.
	Loss of system pressure.	Inspect system as described in Note 1. Check hose connections and tighten as necessary.
	Low coolant protection (should be -40°C).	Test solution as described in Note 3.
	Belt tension too low.	See Note 10.
	Spark timing incorrect.	Set timing to 10° advance.
	Timing retarded by poor function of distributor vacuum advance unit	Check hose for kinks, partial collapse, or poor connections.
	Water pump inoperative.	Repair as required, following Note 9.
	Radiator fins obstructed.	Clean away bugs, leaves, etc.
	Cooling system passages blocked by rust or scale.	Flush system - add fresh coolant.
	Reservoir hose pinched or kinked (especially at radiator filler neck).	Relieve kinks by re-routing. Replace hose if necessary.
	Lower radiator hose collapses.	Check for hose spring position by squeezing lower end of hose. Replace as necessary.
	Defective engine metal temp switch.	Replace switch.
	Exhaust system restriction.	Check muffler and exhaust pipe for collapse.
	Thermostat stuck in closed position.	Replace thermostat.
Loss of coolant.	Leaking radiator.	Inspect cooling system as described in Note 1.
	Leaking coolant reservoir or hose.	Replace reservoir or hose.
	Loose or damaged hoses or connections.	Reseat or replace hoses or clamps.
	Water pump seal leaking.	Repair water pump as described in Note 9.
	Water pump gasket leaking.	Replace gasket.
	Radiator cap damaged, or filler neck distorted.	Inspect cooling system as described in Note 1. If neck is distorted, use wood block and mallet to reform evenly to fit cap.
	Cylinder head gasket leaking.	Replace gasket.
	Improper cylinder head screw torque.	Tighten screws to 115 foot-pounds.
	Cylinder block core plug leaking.	Replace core plug.
	Cracked cylinder head or block or warped cylinder head or block gasket surface.	Resurface or replace.
	Leaking heater core.	Repair or replace core.
	Leaking heater water control valve.	Replace valve.
Engine fails to reach normal operating temperature. (Cool air from heater.)	Thermostat stuck open or wrong type thermostat.	Install new thermostat of correct type and heat range.
	Coolant below add mark.	Add coolant.

BACK TO INDEX

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a red light that reads "STOP ENGINE-TEMPERATURE". It will light whenever engine metal temperature is excessive. In addition to the glowing lamp, the key buzzer will sound.

The engine metal temperature switch, Fig. 6-4, located at the rear of the left cylinder head senses the temperature of the casting rather than the temperature of the coolant. Since the switch screws into a blind hole in the cylinder head, sealer is not required and MUST NOT be used when installing this switch.

Operation of the "STOP ENGINE-TEMPERATURE" light is checked by opening the driver's door while ignition key is in Lock or Off positions. Light should glow and buzzer should sound. The high engine temperature warning system does not utilize the ignition switch "START" ground circuit for testing operation as do the other tell-tale lights. Therefore, the red "STOP ENGINE-TEMPERATURE" light should not glow when the ignition switch is in the Start position.

The transmission oil cooler is located in the outlet tank on the right side of the radiator.

1. System Leak Test

1. Make visual check of hoses and hose connections for leaks. Tighten clamps as required.
2. Install Hose Gage, J-23636, on upper radiator hose all the way, Fig. 6-5.
3. Before installation of Adapter, J-23699, make sure rubber seal on pressure tester is fully extended and making full contact with adapter. Install Adapter, J-23699, on Pressure Tester, J-24460.
4. Remove cap from reservoir and install pump adapter to hose on bottom of cap, Fig. 6-5. Secure with clamp.
5. Pump system to 16 psi and watch for pressure drop on pump gage.

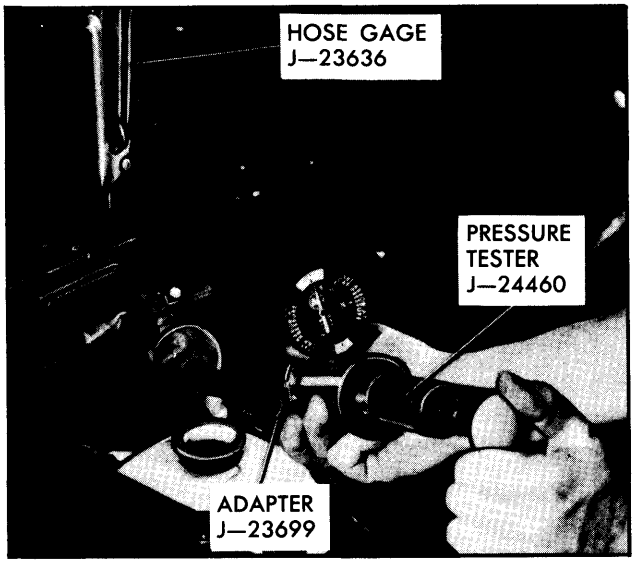


Fig. 6-5 Testing Closed Cooling System

6. If pressure drops below 16 psi in 10 seconds, the cap spring washer gasket, the filler neck nipple, or an overflow hose connection is leaking. If pressure does not drop proceed to Step 12.
7. Open drain valve on radiator and drain until all pressure is out of system. Close valve and proceed.
8. Remove radiator cap and check for weak spring washer or damage to gasket. Check overflow tube to filler neck for solder crack. Check overflow hose for loose connections at each end.
9. If spring washer in cap is weak, install new radiator cap. If nipple is loose or cracked, re-solder. If hose connection is loose, replace clamp.
10. Re-install coolant and cap. If new cap is installed, wet both top and bottom sealing gasket with coolant.
11. Re-install pump to adapter and pressurize system to 16 psi. If system holds pressure for 10 seconds, cap gasket is sealing.
12. To check cap holding pressure, set red washer on hose gage against movable handle.
13. With a *quick* turn, completely separate pump from adapter.

(NOTE: Quick action is necessary to close the drop valve. If movable handle has moved 1/4" or more away from red washer, either the radiator cap is not holding pressure or the pump was not separated quickly enough from the adapter.)

Pump up system again to 16 psi and quickly and completely separate pump from adapter. If handle still moves 1/4" or more, check radiator cap for pressure, as indicated in Step 17. Cap should hold 12 pounds minimum pressure.

14. Make sure red washer is seated against movable handle. After 5 minutes, wiggle hose and note position of movable handle relative to red washer.
15. If handle has not moved more than 1/4 inch in 5 minutes, cooling system is holding sufficient pressure Release system pressure slowly to prevent entry of air into cooling system. Test is complete.
16. If handle has moved more than 1/4 inch, inspect for leaks. Repair as required and repeat Steps 11-15.
17. If leak is not obvious, repeat Steps 3 through 6 and Step 12. Remove adapter from hose on reservoir cap. Insert end of hose in a glass of water below liquid level and watch for bubbles. Presence of bubbles indicates a leaking relief valve or drop valve. Inspect relief valve gasket on cap and inner sealing surface of filler neck for damage or foreign debris.

Cap relief valve may be pressure checked by replacing end of Adapter, J-23699, with radiator cap and pumping pressure tester slowly to obtain minimum holding pressure. A reading of less than 12 pounds indicates a defective cap. If cap is defective, replace cap and repeat Steps 11-15.

18. Remove adapter from bottom of reservoir cap hose if not done in Step 17. Install reservoir cap and remove Hose Gage, J-23636.

BACK TO INDEX

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2. Thermostat Test

The thermostat may be checked by suspending it, with the thermostat heat control unit down, in a small pan of ethylene glycol coolant containing a thermometer. Neither the thermostat nor the thermometer should rest on the bottom of the pan because of the uneven concentration of heat at this point when the pan is heated. The thermostat valve should start to open at a temperature between 177°F and 182°F (81° and 94°C). When the coolant reaches a temperature of 202°F (94°C), the valve should be fully open (approximately 1/4 inch).

3. Testing Coolant Solutions

A hydrometer test will indicate whether ethylene glycol or water or both should be added to maintain the desired freezing point of the solution. The freezing point of the solution should give protection to an acceptable range of - 35° To - 45° (-8° To -45°C), regardless of climatic conditions. This is necessary to provide adequate corrosion protection.

Some devices used for testing solutions will indicate the correct freezing point only when tested at a specific temperature. Other testers provide thermometers and tables indicating freezing points corresponding to readings made at various temperatures. Disregarding the temperature of the solution when testing may cause an error as large as 30°F in determining the freezing point.

SERVICE INFORMATION

4. Cooling System Preventive Maintenance

Every 12 months or 15,000 miles (whichever occurs first) inspect cooling system, wash radiator cap and filler neck, and pressure test cap and system. Tighten hose clamps as necessary and clean exterior of radiator core. Inspect condition of all cooling and heater hoses. Replace hoses if checked, swollen or otherwise deteriorated.

Regardless of climate, the cooling system should be drained, flushed with water only, and refilled every 24 months or 30,000 miles, whichever occurs first, with a 50-50 mixture of water and an ethylene glycol base coolant to protect the engine to at least -35° To -45°F. (-8° To -45°C.). These measures are necessary to retard corrosion, rust, and scale; keep water passages open; and seal against internal or external leakage.

(NOTE: Supplemental inhibitors or additives claiming to provide increased cooling capability that have not been specifically approved by GM are not recommended for addition to the cooling system. These additives may be detrimental to the efficient operation of the system, and they represent an unnecessary operating expense.)

Check coolant level in reservoir at each engine oil change. The coolant reservoir is marked "FULL" and "ADD", Fig. 6-6. These marks are approximately two quarts apart so that one quart of ethylene glycol and one quart of water can be added. The reserve above the full mark is to allow for expansion while parked after hot running. The coolant level should be between the "FULL" and "ADD" marks at normal operating temperature. The level may be observed below the "ADD" mark when the system cools below operating temperature.

5. Cooling System Flushing Procedure

1. Drain coolant from cooling system by opening radiator drain cock and removing two drain plugs from cylinder block. If coolant side of radiator cap is rusty, refill and drain system twice.

2. After drain points have been closed, refill system with fresh water only and install radiator cap. Set defrost lever to "DEF" position and turn temperature to 85°. This opens the water control valve and allows the water to pass through the heater core.

(NOTE: On Fleetwood Seventy-Five Sedans and Limousines, also turn rear heater system on and rotate temperature dial to 85° (25°C).

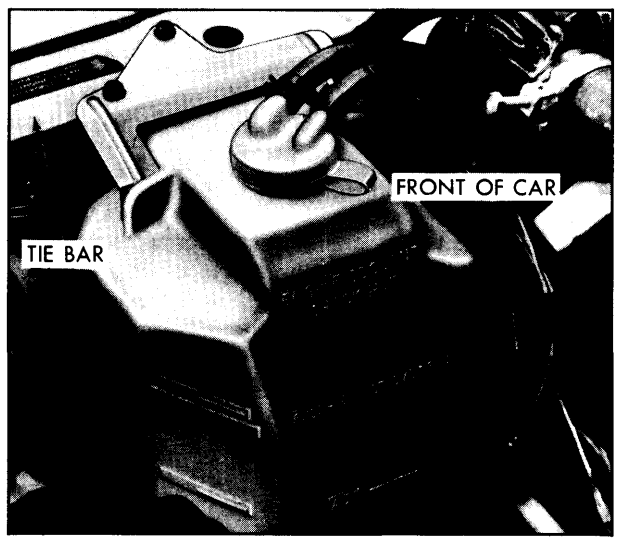


Fig. 6-6 Coolant Reservoir

BACK TO INDEX

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3. Run engine at medium speed for one-half hour at a temperature as hot as possible without boiling. Cover one-half the radiator if necessary.

4. Inspect the following points in the cooling system:

a. Radiator core for leaks.

b. Radiator air passages for plugging caused by bugs, leaves, etc.

c. Condition and tension of drive belts, as described in Note 10.

d. Condition of hoses and tightness of clamps.

5. Drain system by repeating Step 1. If flush water has a rust color, repeat procedure.

6. Add equal amounts of ethylene glycol base coolant and water to protect engine to at least -35° to -45°F. (-8° to -45°C).

(NOTE: Supplemental inhibitors or additives claiming to provide increased cooling capability that have not been specifically approved by GM are not recommended for addition to the cooling system. These additives may be detrimental to the efficient operation of the system, and they represent an unnecessary operating expense.)

7. With the radiator cap removed and heater controls on maximum as outlined in Step 2, run engine with throttle set on fast idle cam for 10 minutes. Add coolant until the radiator is completely full and tighten radiator cap before stopping engine.

8. Check coolant level in the reservoir and add coolant as necessary to bring level up to the "FULL" mark.

9. Deterioration of the hoses in the engine compartment takes place over a period of time due to the exposure to high temperatures in this environment. To protect the engine from damage due to coolant loss, the hoses and clamps in the engine cooling and heater systems should be replaced after two years of service or after 30,000 miles, whichever occurs first.

6. Thermostat

a. Removal

1. Drain radiator until coolant level is below level of thermostat housing.

2. Disconnect upper radiator hose at thermostat housing.

3. Remove two screws securing thermostat housing to cylinder block and remove housing. Discard gasket.

4. Remove thermostat from cylinder block.

b. Installation

1. Install thermostat in opening at top of cylinder block with valve up.

2. Position a new gasket coated with gasket cement on cylinder block.

3. Install thermostat housing on cylinder block and secure with two screws. Tighten screws to 10 foot-pounds.

4. Connect upper radiator hose to thermostat housing.

5. Fill cooling system to proper level.

7. Fan Blade (Flexible Fan)

a. Removal

1. Remove six screws securing radiator cover and one screw securing upper radiator hose brace to cover and remove cover.

2. Unthread four screws holding fan and spacer to water pump hub. Screws cannot be removed due to radiator clearance. Screws are most easily loosened by loosening the generator and rotating the fan to put each screw at the top in turn.

3. Move entire fan assembly (fan, spacer, screws) away from hub to a point near the power steering pump and remove the screws and spacer now that space permits.

4. Remove fan by sliding between cradle and radiator.

b. Installation

WARNING: IT IS ESSENTIAL THAT FAN ASSEMBLIES REMAIN IN PROPER BALANCE AND PROPER BALANCE CANNOT BE ASSURED ONCE A FAN ASSEMBLY HAS BEEN BENT OR DAMAGED. A FAN ASSEMBLY THAT IS NOT IN PROPER BLANCE COULD FAIL AND FLY APART DURING SUBSEQUENT USE CREATING AN EXTREMELY DANGEROUS CONDITION.

IF A FAN BLADE IS BENT OR DAMAGED IN ANY WAY, NO ATTEMPT SHOULD BE MADE TO REPAIR AND REUSE THE DAMAGED PART. A BENT OR DAMAGED FAN ASSEMBLY SHOULD ALWAYS BE REPLACED WITH A NEW FAN ASSEMBLY.

1. Slide fan between radiator cradle and radiator and temporarily position near power steering pump.

2. Insert four screws through fan and spacer.

3. Make sure mounting holes in water pump pulley line up with threaded holes in water pump hub.

4. Position fan assembly to water pump hub and tighten screws to 18 foot-pounds.

5. Position radiator cover and secure with six screws.

6. Secure upper radiator hose to radiator cover with one screw.

8. Clutch Fan Assembly (Heavy Duty Cooling)

a. Removal

1. Remove six screws securing radiator cover and one screw securing radiator hose brace to cover. Remove cover.

2. Remove four nuts securing clutch hub to fan hub.

3. Remove fan and clutch by pulling forward off studs and then straight up.

b. Installation

NOTE: OBSERVE WARNING IN NOTE 7b.

1. Secure fan blade to clutch with four screws. Tighten screws to 18 foot-pounds.

BACK TO INDEX

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2. Slide fan and clutch into position and install four attaching nuts. Tighten nuts to 18 foot-pounds.
3. Position radiator cover and secure with six screws.
4. Secure upper radiator hose to radiator cover with one screw.

9. Water Pump Overhaul

(NOTE: Some water pumps may have a greenish coolant stain at the vent hole below the shaft. This is a normal condition. The water pump should not be serviced unless it is obviously leaking with the engine running and under pressure.)

a. Removal

1. Disconnect negative battery cable.
2. Drain radiator.
3. Remove fan assembly as described in Notes 7a or 8a.
4. Loosen generator mounting screws and remove generator belt.
5. Loosen A.I.R. pump mounting screws and remove drive belt.
6. Loosen power steering pump mounting screws and remove power steering pump belt.
7. Remove water pump pulley from shaft.
8. Disconnect water inlet hose from water pump.
9. Loosen four screws securing crankshaft pulley to hub approximately 1/2 way and move pulley out slightly.
10. Remove 11 screws securing water pump to engine front cover and remove pump. Discard gasket and clean gasket surfaces.
11. Remove studs from pump flange if vehicle is so equipped.

b. Disassembly

1. Position Support, J-23675-4, around shaft of water pump between pump body and flange so that water pump casting fits in slight recess, Fig. 6-7.

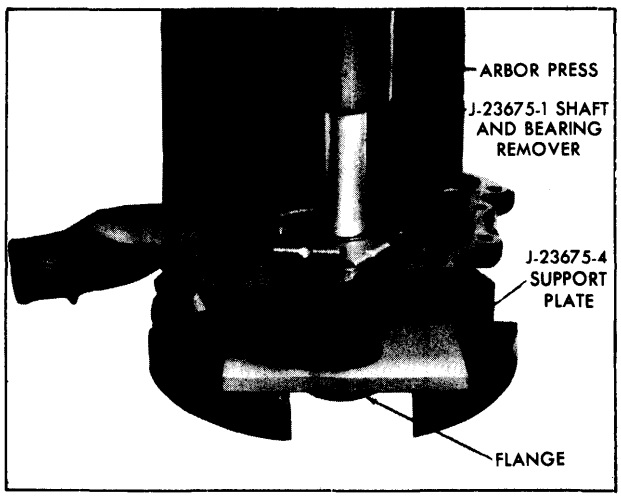


Fig. 6-7 Disassembling Water Pump

2. Position pump impeller-side-up in arbor press so that shaft and bearing assembly is free to move when pressed.
3. Position J-23675-1 on impeller side of shaft and press shaft and bearing assembly and impeller hub through impeller and pump body and out front of pump, Fig. 6-7.
4. Remove special tools and remove impeller from pump body.
5. Discard all parts except pump body, Fig. 6-3.

c. Assembly

1. Position Bearing Locator, J-23675-3, into rear of pump and place pump, face up, in arbor press, Fig. 6-8.

(NOTE: Locator, J-23675-3, determines depth that bearing is installed in water pump body. The body rests on the lower step and bearing outer race bottoms against the upper step upon installation of the bearing.)

2. Using Shaft and Bearing Installer, J-23675-2, press shaft and bearing into pump until bearing outer race bottoms on Locator, J-23675-3, Fig. 6-8.

(NOTE: If a hydraulic press is used, care should be exercised not to exert excessive pressure on the pins of J-23675-2. If available, a press without hydraulic assist is best used for this job.)

Installer, J-23675-2, acts only as an installer, not as a gage. The notches on the pins of J-23675-2 accommodate production variations of the flange and bearing assembly and water pump body. On a few pumps, outer race of bearing may be below water pump body. However, the low steps of J-23675-2 will never touch the pump body when correctly installed.

3. Position Support, J-23675-4, between water pump body and flange, so that water pump casting fits in slight recess, Fig. 6-9.

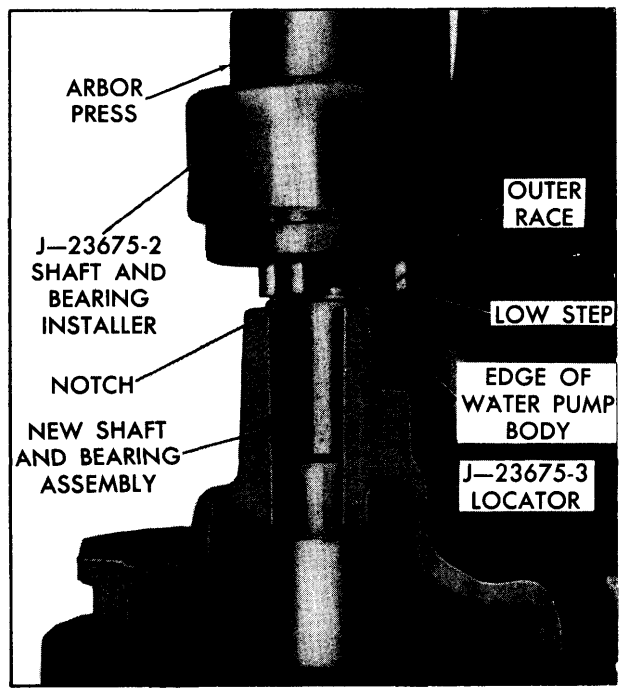


Fig. 6-8 Installing Shaft and Bearings

BACK TO INDEX

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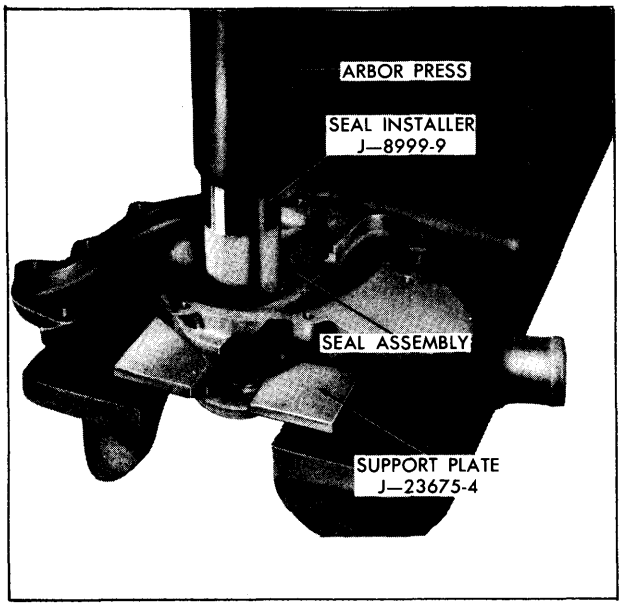


Fig. 6-9 Installing Seal

4. Position new seal assembly over shaft with spring end up and press into position using Seal Installer, J-8999-9, Fig. 6-9.

(NOTE: Support Plate, J-23675-4, supports the pump body as the seal assembly is seated against the body. This arrangement prevents an accidental dislocation of the bearing in its relation to the pump body.)

5. Dip ceramic seal in ethylene glycol before installing over shaft. Install ceramic seal and drive rubber over shaft with ceramic side down.

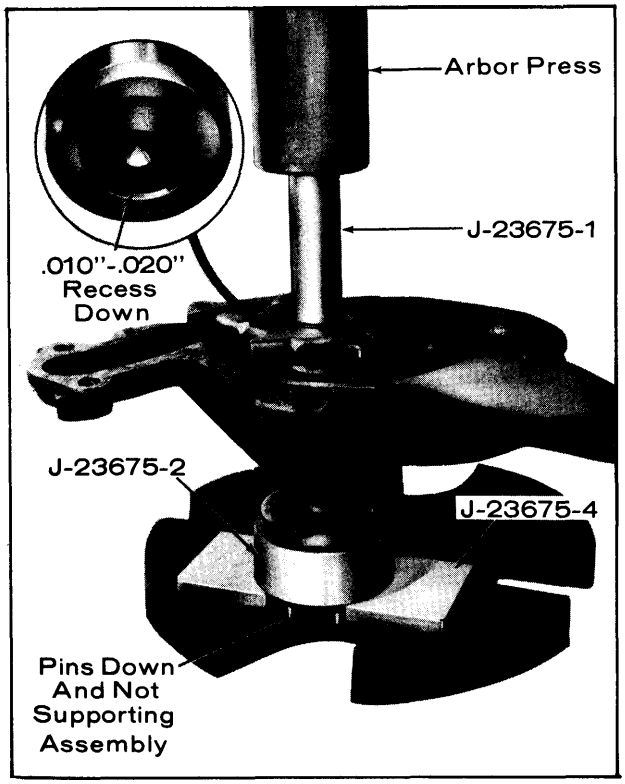


Fig. 6-10 Installing Impeller

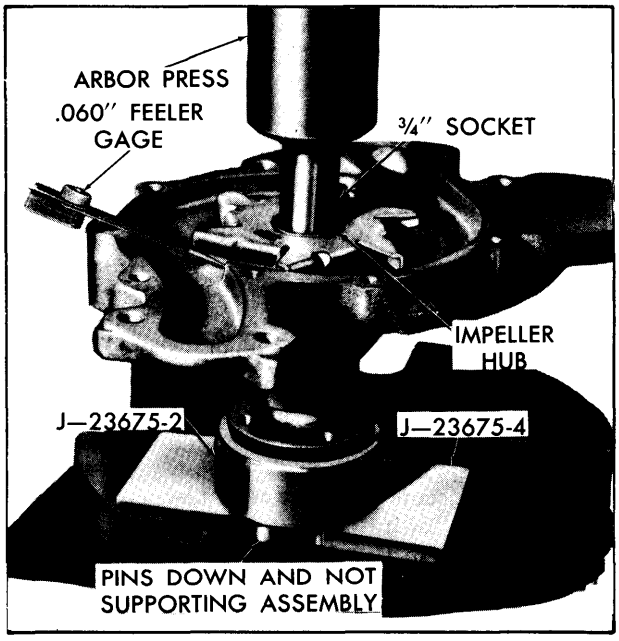


Fig. 6-11 Gaging Impeller

6. Position Bearing Installer, J-23675-2, with pins down and not supporting assembly into cut out section of Support Plate, J-23675-4, and position shaft on flange into hole in J-23675-2, Fig. 6-10.

7. Position impeller vanes down over shaft and exactly center recess of J-23675-1 on impeller hub. Fig. 6-10. Press impeller into position until tool bottoms on shaft.

(NOTE: J-23675-1 positions the impeller so the shaft is .010"0.20" above impeller hub. This aligns the impeller so the blades will not strike the engine front cover. When installing the impeller, shaft is supported on its ends by J-23675-1 and J-23675-2. This arrangement prevents an accidental dislocation of the bearing in its relation to the pump body.)

8. Check to see that impeller does not strike engine front cover upon installation. This may be done by placing a straight edge across the body and rotating the impeller. Shaft and impeller blades should clear the straight edge.

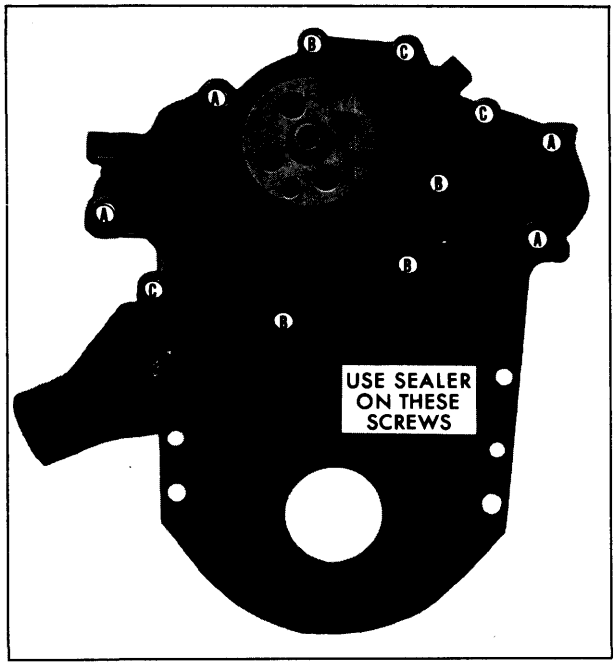
9. If blades clear, install pump on car. If the blades do not clear, the following corrective action may be taken.

10. Repeat Steps 6 and 7 and check for impeller clearance. Also, if blades do not stick out past the body excessively, the engine front cover gasket may provide the necessary clearance.

11. If Step 10 does not correct problem, an attempt may be made to relocate the impeller hub. Position Bearing Installer, J-23675-2, with pins down and not supporting assembly, into cut out section of Support Plate, J-23675-4. Position shaft on flange into hole in J-23675-2, Fig. 6-11. Center a 3/4" socket on impeller hub and insert .060" feeler gage between pump body and impeller blade. Carefully press impeller hub until

BACK TO INDEX

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Key	No.	Size	Torque
A	(4)	3/8 - 16 x 1-3/8	22 foot-pounds
B	(4)	1/4 - 20 x 1-1/8	70 inch-pounds
C	(3)	5/16 - 18 x 1-1/4	15 foot-pounds

Fig. 6-12 Water Pump Assembly Attaching Screws

correct clearance is obtained. Specification between body and blade is .030" to .060".

CAUTION: Do not press too far or rebuilt pump may be damaged.

12. Install studs to pump flange if fan clutch is to be used.

d. Installation

1. Position new gasket on water pump flange.
2. Position pump on engine, lining up holes in pump with holes in engine front cover, and install eleven screws with sealer as indicated in Fig. 6-12.
3. Tighten four crankshaft pulley to hub screws to 15 foot-pounds.
4. Connect water inlet hose to pump.
5. Position water pump pulley on pump.
6. Loosely install all drive belts.
7. Install fan assembly as described in Notes 7b or 8b.
8. Tension all drive belts as described in Note 10.
9. Fill cooling system to proper concentration and level with ethylene glycol base coolant.
10. Reconnect negative battery cable.
11. Run engine and check for leaks.

10. Belt Adjustments

a. Checking Drive Belts.

1. Drive belts should be checked for signs of wear, cuts, and fraying. Deteriorated belts should be replaced.
2. Place Belt Tension Gage, J-23600 midway between pulleys on drive belt being checked, locations A,B,C or D indicated in Fig. 6-13.
3. Check gage reading for belt being checked. Proper belt tension is shown in the table on Page 6-5. If belt tension is incorrect, adjust specific belt according to the corresponding procedure described in b, c, d, or e of this note.

(NOTE: A belt that has been previously tensioned is considered a used belt. A belt that has never been tensioned is considered a new belt.)

4. If, after tensioning, a belt fails to maintain the minimum tension specified in chart, it should be replaced.

b. Generator Belt Tension (Except H.D. Generator)

1. Place Belt Tension Gage, J-23600 on drive belt midway between pulleys at location A in Fig. 6-13.
2. Loosen generator link adjusting screw and pivot screw under generator.
3. Move generator as required until correct belt tension is obtained on gage.
4. Tighten generator link adjusting screw to 20 foot-pounds.
5. Tighten pivot screw under generator to 28 foot-pounds and remove Belt Tension Gage.

c. Power Steering Pump and/or Air Conditioning Compressor Belt Tension

1. Place Belt Tension Gage, J-23600 on drive belt midway between pulleys at location "B" in Fig. 6-13.
2. Loosen, (1) steering pump adjusting nut at top of pump mounting bracket, (2) lower adjusting slot bolt and (3) pivot bolt.
3. Move power steering pump as required until correct belt tension is obtained on gage.
4. Snug lower adjusting slot bolt.
5. Snug lower pivot bolt.
6. Snug upper adjusting slot nut.
7. Tighten lower adjusting slot bolt to 30 foot-pounds.
8. Tighten lower pivot bolt to 30 foot-pounds.
9. Tighten upper adjusting slot nut to 22 foot-pounds.

BACK TO INDEX

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d. A.I.R. Pump Belt Tension

1. Raise front of car.
2. Loosen A.I.R. Pump pivot bolt.
3. Place Belt Tension Gage, J-23600 on drive belt midway between pulleys at location C in Fig. 6-13.
4. Loosen A.I.R. Pump adjuster link screw below pump.
5. Move A.I.R. Pump as required until correct belt tension is obtained on gage.

CAUTION: To avoid internal damage, pry as close to rear of pump cover as possible, near dowel pin.

6. Tighten adjuster link screw to 20 ft. lbs.
7. Tighten pivot screw to 25 ft. lbs. and remove Belt Tension Gage.
8. Lower car.

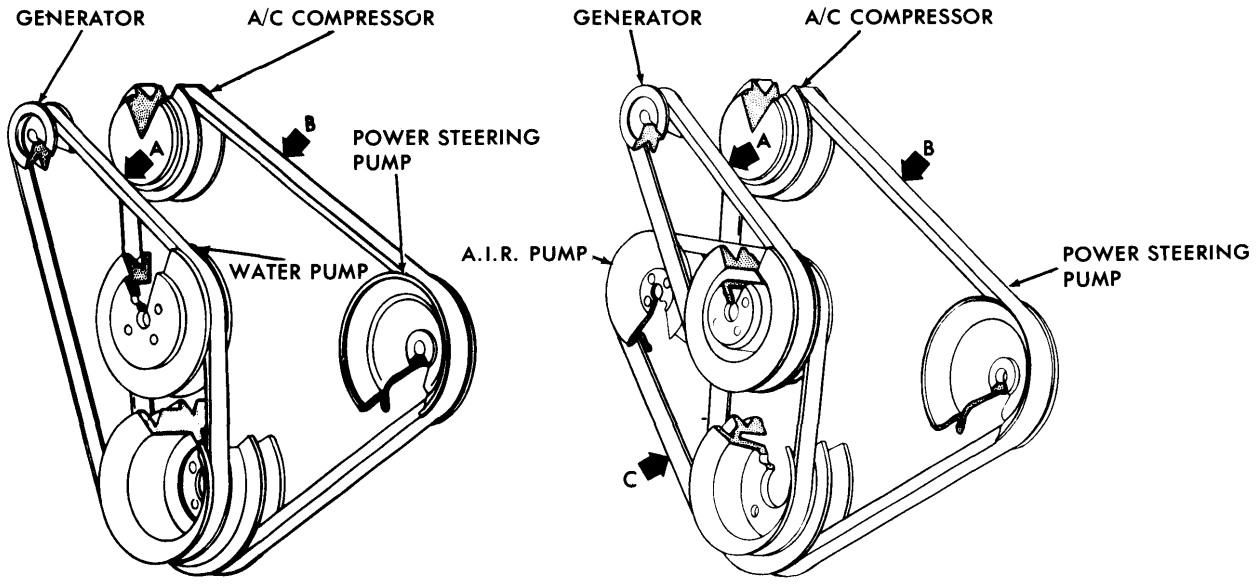
e. Heavy Duty Generator Belt Tension

1. Place belt tension gage, J-23600 on drive belt midway between pulleys at location A in Fig. 6-13.
2. Loosen idler bracket adjusting and pivot bolts, Fig. 6-16.
3. Move idler pulley as required until correct belt tension is obtained on gage.
4. Tighten idler adjusting bolt to 20 foot-pounds.
5. Tighten idler pivot bolt to 28 foot-pounds and remove belt tension gage.

BACK TO INDEX

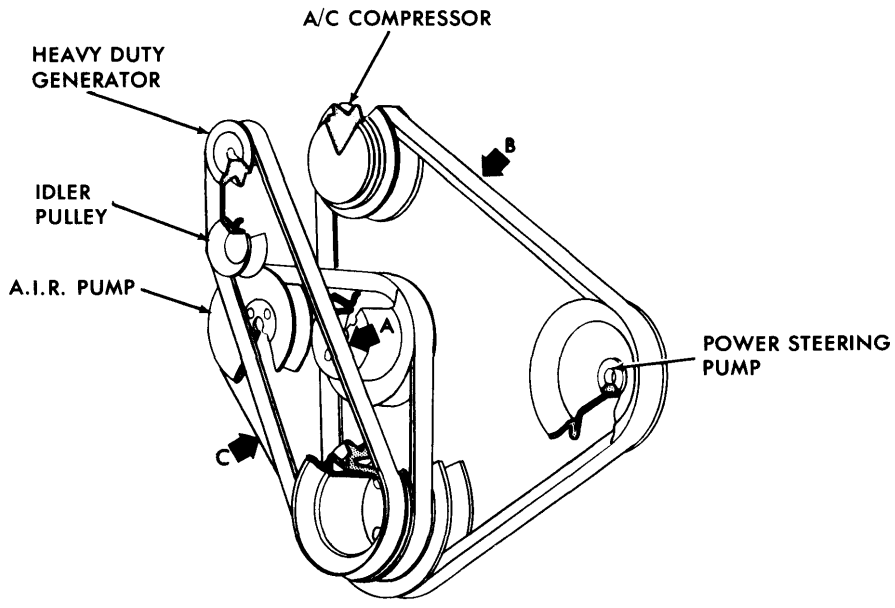
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EXCEPT COMMERCIAL CHASSIS



WITHOUT A.I.R. WITH A.I.R.

COMMERCIAL CHASSIS ONLY



WITH H.D. GENERATOR

Fig. 6-13 Belt Tensioning

BACK TO INDEX

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ENGINE ACCESSORY DRIVE BELTS

Belts	Type	Tension		Fedral		California	
		New	Used	Width	Length	Width	Length
A.I.R. Pump	36° Wedge	170 Lbs.	120 Lbs.	.500"	46.5"	.500"	46.5"
Generator							
63 AMP	39° Wedge	100 Lbs.	70 Lbs.	.4 0"	51.0"	.410"	37.0"
80 AMP	39° Wedge	100 Lbs.	70 Lbs.	.4 0"	52.0"	.410"	38.5"
145 AMP	36° Wedge	170 Lbs.	120 Lbs.	.500"	57.5"	.500"	57.5"
Power Steering Pump and Air Conditioning Compressor	36° Wedge	170 Lbs.	120 Lbs.	.500"	60.5"	.500"	60.5"

SPECIFICATIONS

Fan, Number of Blades	
Except Eldorado	5
Eldorado	7
Heavy Duty, 75 and Comm.	7*
Hoses	
Type	Reinforced Molded
Inside Diameter	1.50"
Thermostat	
Starts to Open	177°F. to 182°F.
Fully Open (Approximately 1/4")	202°F.
Drive Belt Ratios	
Water Pump Without A.I.R.	1.24 to 1
With A.I.R.	1.14 to1
Generator	
63 Amp. without A.I.R.	3.09 to 1
63 Amp. with A.I.R.	3.36 to 1
80 Amp. without A.I.R.	2.86 to 1
80 Amp. with A.I.R.	3.12 to 1
Generator–145 Amp.	2.28 to 1
Power Steering Pump	1.26 to 1
Air Conditioning Compressor	1.48 to 1
A.I.R. Pump	1.20 to 1
Capacity of System	
All Except Seventy-Five Series	23.0 Qts.
Seventy-Five Series	25.8 Qts.
Area of Core	552 Sq. In.
Core Depth	1.96 In.
Core Center Constant	.14 In.
Tubing Spacing	.55 In.
Radiator Cap Pressure	13.5 to 16.5 psi

*With Fan Clutch

BACK TO INDEX

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TORQUE SPECIFICATIONS

Material Number	Application	Size	Torque
280M	Fan Blade Assembly Mounting Screw/Nut	5/16-24	18 Ft. Lbs.
1010	Heater Hose Clamp	10-24	13 In. Lbs.
280M	Thermostat Housing Screw	5/16-18	10 Ft. Lbs.
260M	*Water Pump to Cylinder Block Screw	3/8-16	22 Ft. Lbs.
260M	*Water Pump to Cylinder Block	5/16-18	15 Ft. Lbs.
260M	*Water Pump to Front Cover Screw	1/4-20	70 In. Lbs.
	*Refer to Fig. 6-12 for proper screw location.		

NOTE: Refer to back of manual, Page 16-1 for nut and bolt markings and Steel Classifications.

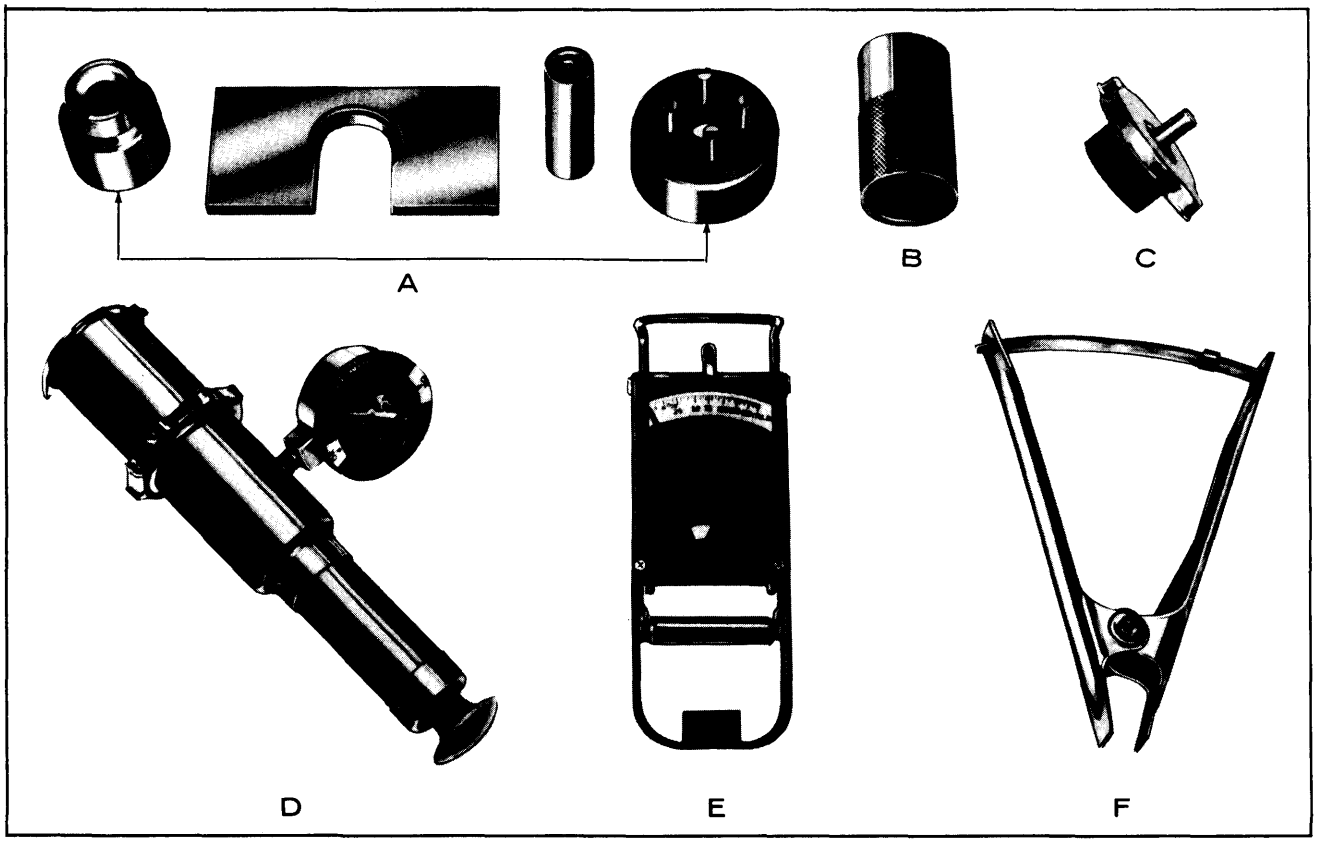


Fig. 6-14 Special Tools

KEY	TOOL NUMBER	NAME
A	J-23675*	Water Pump Overhaul Kit
B	J-8999-9	Seal Installer
C	J-23699	Pressure Tester Adapter
D	J-24460	Pressure Tester
E	J-23600	Belt Tension Gage
F	J-23636	Hose Gage

*Water Pump Overhaul Kit, J-23675, consists of:

One J-23675-1 Shaft and Bearing Assembly Remover
One J-23675-2 Shaft and Bearing Assembly Installer
One J-23675-3 Shaft and Bearing Locator
One J-23675-4 Support Plate

BACK TO INDEX

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THEORY OF OPERATION

BATTERY

Battery

The sealed negative-ground battery, Fig. 6-15 is mounted on a tray to the right of the radiator and is secured to the battery tray by an over-the-top retainer. The battery has a cranking capacity of 3500 watts at 0°F. (-18°C).

The lead acid battery is a source of electrical energy that operates or assists in supplying current to the electrical accessories. Active materials within the battery react chemically to produce a flow of direct current whenever a current-consuming device, a load, is connected to the battery terminals. All batteries have screw type side mounted battery cable terminals.

Chemistry and construction methods provide the following advantages:

Water never needs to be added to the battery.

The battery is completely sealed except for two small vent holes on the side. The vent holes allow what small amount of gases are produced in the battery to escape. The special chemical composition inside the battery reduces the production of gas to an extremely small amount at normal charging voltages.

The battery has a very strong ability to withstand damaging effects of overcharge. Also, the terminals are sealed tightly to retard leakage. A charge indicator in the cover indicates state of charge.

Compared to an ordinary battery whose performance decreases steadily with age, the sealed battery delivers more available power at any time during its life. The battery has reduced susceptibility to self-discharge as compared to an ordinary battery.

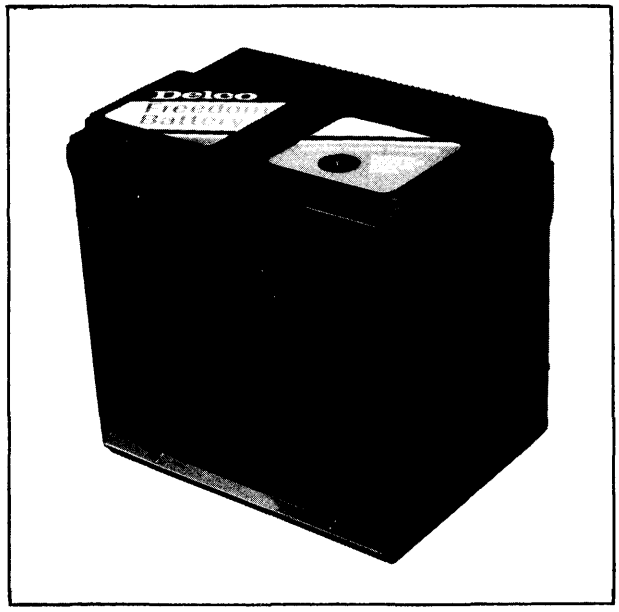


Fig. 6-15 Battery

DIAGNOSIS

11. Battery Visual Inspection

1. Inspect both positive and negative cables and connections for damage or corrosion. Ground cable connection at frame must be clean and tight.

2. The battery terminals should be inspected for corrosion. Corrosion appears as a white powdery substance. If corroded, they should be cleaned as described in Note 16.

3. Inspect metal carrier for corrosion. If corrosion exists, it will be necessary to remove retainer and battery from car and pour warm soda or ammonia water over corroded areas to loosen the corrosion so that it can be brushed off and flushed away.

4. The hold-down retainer (Fig. 6-16) should be inspected to see that it is tight enough to prevent the battery from shaking in its holder and damaging the battery case.

5. Examine battery for cracks in case and excessive looseness in battery tray.

12. Charge Indicator (Fig. 6-11)

a. Green Dot Visible

If the charge indicator is dark and has a green dot in the center, the battery is sufficiently charged for testing. Proceed to Note 14 Step 3.

b. Dark—Green Dot Not Visible

If the charge indicator is dark and the green dot is not visible, charge battery until green dot appears, but not more than 60 ampere-hours—(for example—15 amperes for four hours). Proceed to Note 14 Step 3.

(NOTE: A battery that required charging for testing may indicate a need for checking the charging system of the vehicle, Note 34.)

c. Light

If the charge indicator is light and a cranking complaint has been experienced, replace battery. (DO

BACK TO INDEX

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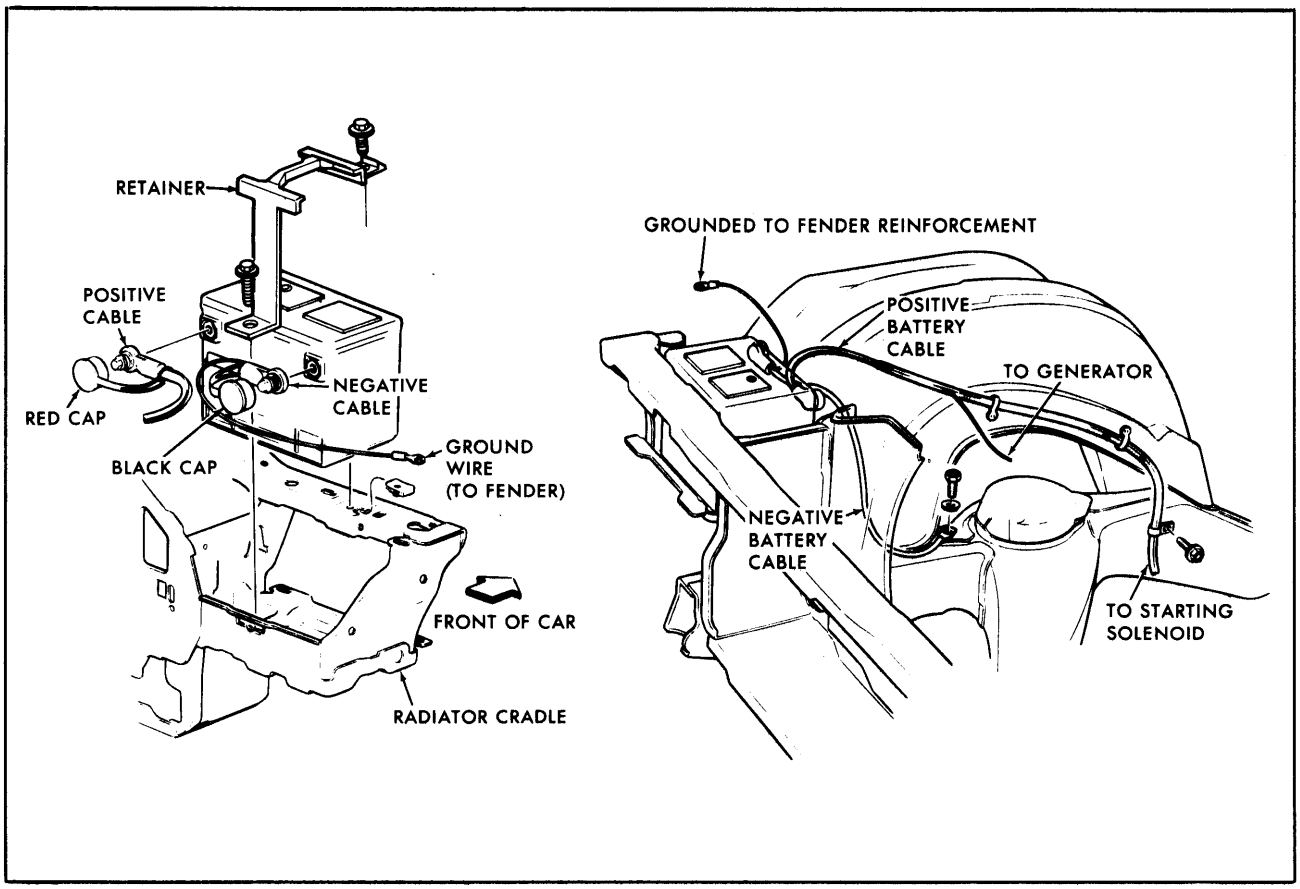


Fig. 6-16 Battery Retainer

NOT attempt charging or testing when indicator is light.)

(NOTE: A battery that failed prematurely, and exhibited a light indicator condition may indicate a need for checking the charging system of the vehicle, Note 34.)

13. Testing Battery Condition

A battery testing instrument, designated a "421 Tester", is recommended to test the solid top batteries of all Cadillac vehicles. These "421" Testers, manufactured by several test equipment companies, will quickly determine the condition of a battery relative to state of charge and ability to provide satisfactory performance.

(NOTE: Do not charge batteries prior to making test. Be certain to obtain clean and tight connections before performing the "421" test.)

1. Perform "421" battery test following instructions on your particular test instrument.
2. Batteries designated Bad by "421" tester should be replaced.
3. Batteries designated Good by "421" tester may be returned to service if there is no owner complaint or other indication of poor performance.

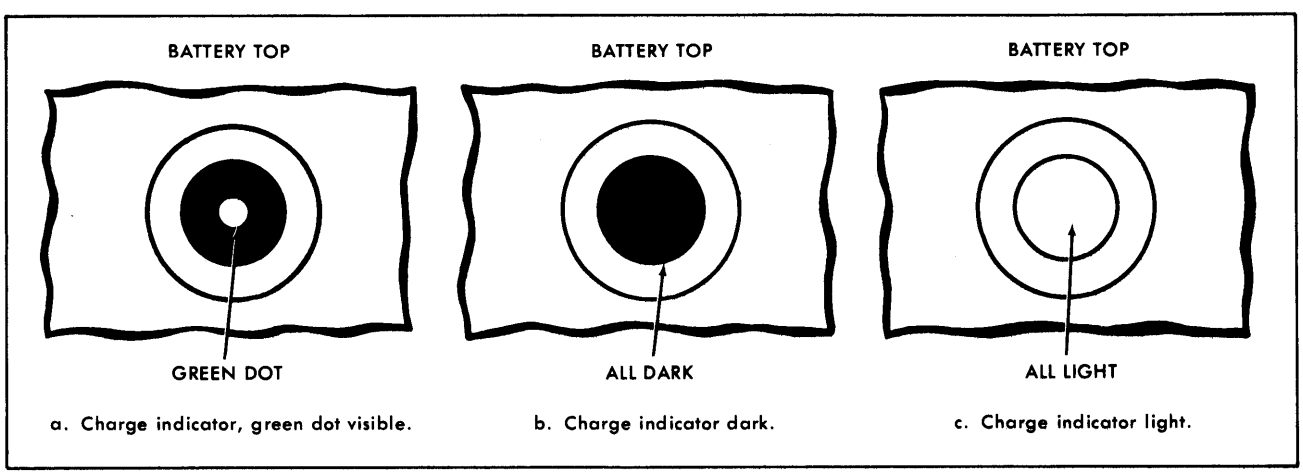


Fig. 6-17 Charge Indicator

BACK TO INDEX

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4. Batteries designated Good by "421" tester, but are questionable in service because of owner complaint or age of battery, should be further tested as outlined in Note 14.

14. Battery Load Test

1. If green dot is visible proceed to Step 2, if not charge battery until green dot is visible (1.220 specific gravity). Then connect a 300 amp load for 15 seconds to remove surface charge from battery. For a more reliable indication of state of charge in Step 5. If this is not possible replace battery.
2. Estimate temperature of battery by taping glass bulb thermometer, such as J-5421 to side of battery case.
3. Connect a voltmeter across the battery terminals.
4. Apply a 220 amp load and read the voltmeter after 15 seconds with the load connected.
5. Remove load and read thermometer.

Temperature °F	Temperature °C	Minimum Voltage
21° or greater	21° or greater	9.6
18° to 21°	18° to 21°	9.5
10° to 18°	10° to 18°	9.4
4° to 10°	4° to 10°	9.3
-1° to 4°	-1° to 4°	9.1
-7° to -1°	-7° to -1°	8.9
-12° to -7°	-12° to -7°	8.7
-18° to -12°	-18° to -12°	8.5

6. Compare temperature and voltage readings with the following chart.
7. If voltage is less than the minimum specified in chart, replace battery.
8. If voltage is the same as or greater than minimum specified in chart, fully charge, clean terminals, as described in Note 16, and return battery to service.

SERVICE INFORMATION

BATTERY

CAUTION: Never expose battery to open flame or electric spark – battery action generates hydrogen gas which is flammable and explosive. Don't allow battery fluid to contact eyes, skin, fabrics, or painted surfaces – fluid is a sulfuric acid solution which could cause serious personal injury or property damage. Flush any contacted area immediately with water. Wear eye protection such as industrial safety spectacles or goggles when working on or near battery. Remove rings, metal watch bands and other metal jewelry before jump starting or working around a battery. Be careful in using metal tools and equipment. If such metal should contact the positive battery terminal (or metal in contact with it) and any other metal on the car, a short circuit may occur which could cause personal injury. Batteries and battery acid should always be kept out of reach of children.

(NOTE: When reconnecting battery terminals on a Theft Deterrent System equipped car, expect the car horns to sound once as they do when the alarm is activated. This is normal and the alarm may be turned off by turning door key to unlock and disarm system, although generally this will not be necessary.)

15. Causes of Low Battery Conditions

Common causes of low battery conditions other than those due to a defective battery are listed below, and should be investigated when there are indications that the car has a consistently low battery.

1. Excessive use of accessories with the engine not running.
2. Leaving lights on or doors open.
3. Improper installation of accessories.
4. Generator belt loose.
5. Self-discharge resulting from a dirty battery case.
6. Loose battery cables.
7. Low generator output, which may be checked and corrected as explained in Note 34.
8. High resistance in charging circuits.

16. Battery Cable Service

Improperly torqued side terminal battery cables can cause high resistances to develop which may lead to hard starting conditions. The following procedure is recommended should this condition be encountered.

1. Remove negative battery cable.
2. Clean threads and end of cable screw with a wire brush. Cleaning of the screw end is particularly important.
3. Clean the internal threads in the battery case and the end of the hole where the cable screw makes contact. A 3/8-16 bottoming tap can be used to clean the threads, however, extreme caution should be exercised to see that the 70 inch-pound torque limit is not exceeded.
4. Repeat Steps 1 thru 3 for the positive cable.
5. Install positive cable and torque to 70 inch-pounds. Install protective cover.
6. Install negative cable and torque to 70 inch-pounds. Install protective cover.

17. Pushing or Pulling Car to Start Engine

AUTION: Vehicle must not be pushed or towed to start.

BACK TO INDEX

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Since there is no direct mechanical link from the engine to the drive wheels, any attempt to start the engine by pushing the car will be unsuccessful. Should the battery become discharged, it will be necessary to use an auxiliary battery with jumper cables to start the engine.

a. Jump Starting with Auxiliary (Booster) Battery

CAUTION: The following jump start procedure is for use only under the following conditions. Departures from these conditions and procedures, could result in: (1) serious personal injury (particularly to eyes) or property damage from such things as battery acid or electrical burns, or (2) damage to electronic components in either vehicle. If all the conditions cannot be met, or if you are uncertain about them, we strongly recommend for your safety and that of the car that jump starting be done only by a competent mechanic.

The battery in the other vehicle must be 12 volts and negatively grounded. The nominal voltage and grounding of the vehicle's battery may be determined by checking the specifications in its owner's manual. Use of a booster battery of a higher nominal voltage, or which is positively grounded may result in serious personal injury or property damage.

CAUTION: Never expose battery to open flame or electric spark–battery action generates hydrogen gas which is flammable and explosive. Don't allow battery fluid to contact eyes, skin, fabrics, or painted surfaces–fluid is a corrosive sulfuric acid solution which could cause serious personal injury or property damage. Flush any contacted area immediately with water. Wear eye protection such as industrial safety spectacles or goggles when working on or near battery. Remove rings, metal watch bands and other metal jewelry before jump starting or working around a battery. Be careful in using metal tools and equipment. If such metal should contact the positive battery terminal (or metal in contact with it) and any other metal on the car, a short circuit may occur which could cause personal injury. Batteries and acid should always be kept out of reach of children.

The battery is a freedom sealed-type battery which does not have filler openings or caps. If the car contains a replacement battery other than a sealed type, refer to jump starting instructions provided by the manufacturer of the battery.

b. Jump Start Procedure

1. Position the two vehicles so they are NOT touching. Set parking brake and place automatic transmission in "PARK" in each vehicle. Also turn off lights, heater and all other unneccessary electrical loads.

2. Remove the vent caps from the battery in the other car (unless it also is equipped with A Delco Freedom Battery. Lay a cloth over the open vent wells. These two actions help reduce the explosion hazard always present in a battery when connecting "live" booster batteries to "dead" batteries. For safety's sake, do not remove any of the flame arrestor vent caps from a battery so equipped.

3. Attach one end of one jumper cable to the positive terminal (identified by a red color,"+" or "P" on the battery case, post or clamp) of the battery in the booster battery, and the other end of the same cable to the positive terminal of the discharged battery.

4. Attach one end of the remaining jumper cable FIRST to the negative terminal (black color, "-" or "N") of the battery in the booster battery, and THEN the other end of the same cable to the negative terminal of the discharged battery. Take care that clamps from one cable do not inadvertently touch the clamps on the other cable. Do not lean over the battery when making this connection.

5. Start the engine in the vehicle that is providing the jump start. Let it run a few minutes, then start the engine in the car with the discharged battery.

6. Reverse the above sequence exactly when removing the jumper cables. Reinstall vent caps, if so equipped, and dispose in a safe manner of any cloths used to cover vent wells, as the cloths may have corrosive acid on them.

18. Charging Instructions

1. Charge at maximum setting of charger for the length of time required to obtain 60 ampere-hours of charge. Examples.

INITIAL CHARGE RATE	HRS. TO CHARGE*
90 Amps	2/3
60 Amps	1
30Amps	2
15 Amps	4

*Initial charge rate is the current that the energizer will accept at the start of charging. As the energizer is charged this rate will decrease.

When a charger does not have an ammeter, place a test ammeter in series with the charger to determine the initial charge rate.

If energizer temperature is 32°F (0°C) or less, energizer should be charged for 1/2 hour at charger's highest setting before the charge rate is determined.

2. Do not exceed the calculated hours of charge, as overheating and spewing of acid might result. In case of spewing, shut off charger and proceed with testing.

BACK TO INDEX

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THEORY OF OPERATION
STARTER

Starter

The starter Motor Fig. 6-18 is mounted on the right rear side of the engine. The starter motor has four pole shoes with two series fields. The drive end housing encloses the entire shift lever mechanism. An over-running clutch drive is used to engage the cranking motor pinion with the engine ring gear.

When the control switch is closed, the solenoid is energized, shifting the cranking motor pinion into mesh with the ring gear. The main contacts of the solenoid are then closed so that battery current is delivered to the starter motor.

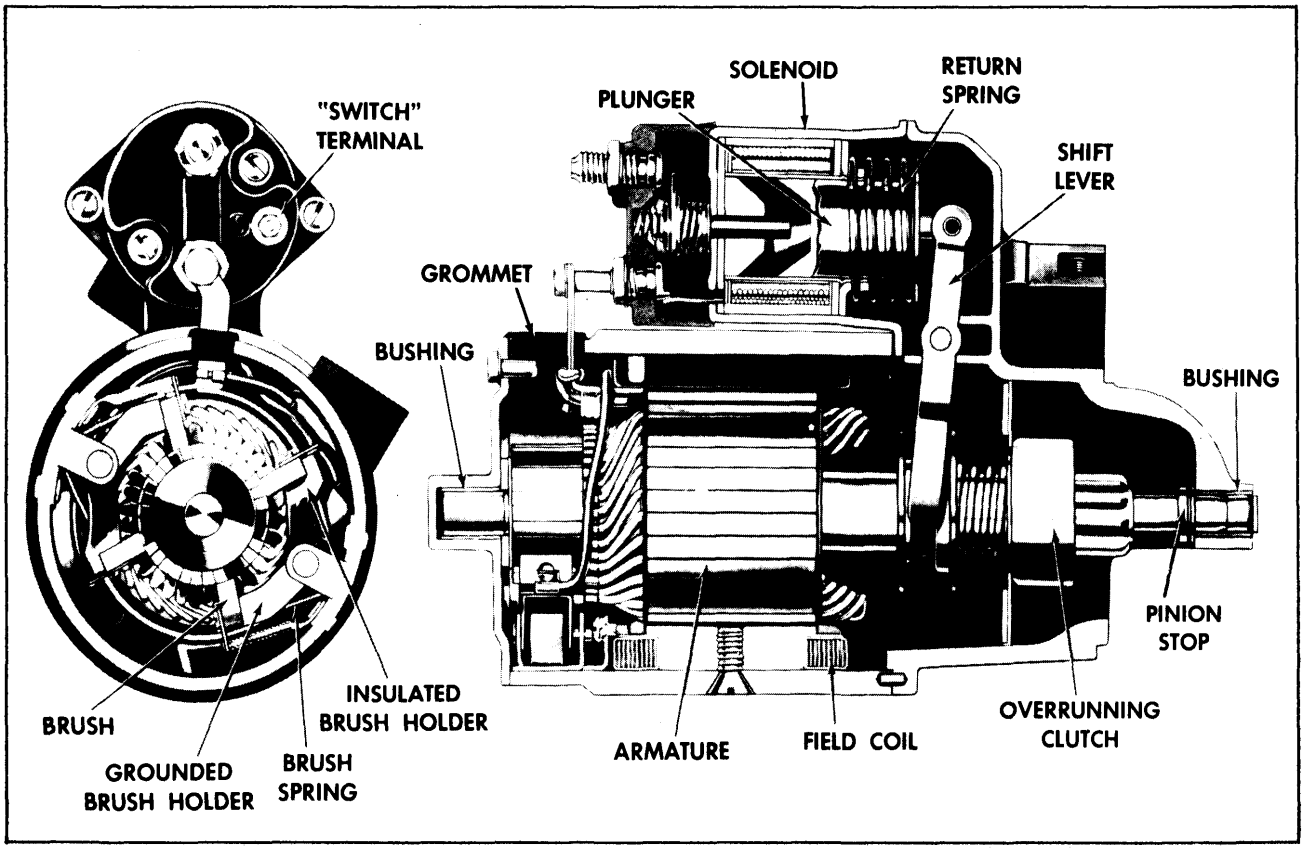


Fig. 6-18 Starter Motor Cutaway View

BACK TO INDEX

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STARTING SYSTEM DIAGNOSIS

19. Cranking Voltage Test

1. Disconnect H.E.I. harness connector at distributor.
2. With volmeter on 16 volt scale, crank engine.
3. Observe cranking voltage and engine speed. Voltage should be greater than 9 volts. Cranking speed should be at least 200 RPM (at room temperature).
4. If cranking voltage and engine speed are correct, shut off ignition and re-connect H.E.I. harness connector at distributor.
5. If voltage and engine speed are not correct, further testing of the battery, Notes 11 through 14 and starter circuit, Note 21 must be performed.

20. Starter Motor Circuit Resistance Test

a. Battery Cable and Starter Switch Test— Insulated Circuit Test

This test measures the resistance of the cables and switches that feed the starter motor. The heavy current used by the starter motor will produce a voltage drop in the wiring which can be measured as an indication of this resistance. The battery should be fully charged.

1. Disconnect H.E.I. harness connector at distributor.
2. Using Battery Starter Tester, turn voltmeter selector switch to 16-volt scale.
3. Connect starter solenoid remote switch and test leads as shown in Fig. 6-19.
4. Connect positive voltmeter lead to positive battery terminal screw. Connect negative voltmeter lead to starter "motor" terminal, Fig. 6-19.
5. Close starter solenoid remote switch, and turn voltmeter to 4 volt scale while cranking. Observe reading, and immediately turn meter back to 16 volt scale.
6. Voltmeter should show .6 of a volt or less while engine is being cranked. If voltage drop is more than .6 of a volt, it is an indication that the cables or connections are dirty or corroded, the solenoid switch is defective, the starter motor is drawing too much current, or that the engine torque requirement is high.
7. If voltage drop across the entire insulated side of the battery starter circuit exceeds the specified .6 volt, test the individual parts of the insulated circuit for excessive resistance. Maximum voltage drop for each should not exceed the following specifications:

a. Battery to Solenoid Switch	.4 volt
b. Across Solenoid Battery Terminal	.2 volt
c. Solenoid Switch to Starter Terminal	Zero

b. Ground Circuit Test

1. Turn voltmeter selector switch of Battery Starter Tester to 4 volt position.
2. Connect test leads as shown in Fig. 6-19.
3. Connect starter solenoid remote switch as shown in Fig. 6-19.
4. Connect negative voltmeter lead to negative battery terminal screw.
5. Connect positive voltmeter lead to the starting motor through bolt.
6. With starter motor cranking engine, voltage drop should not exceed .3 volt. A reading of more than .3 volt is usually an indication of resistance due to loose, dirty, or corroded connections.
7. Reconnect H.E.I. harness connector at distributor.

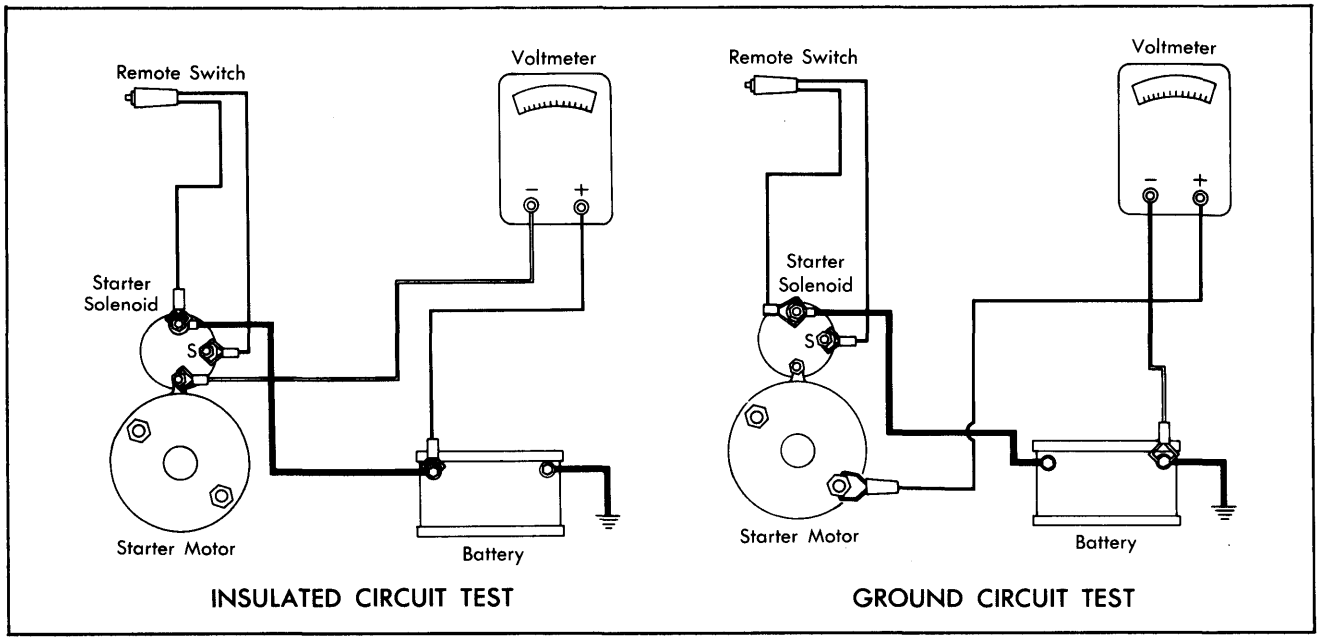


Fig. 6-19 Starting Circuit Tests

BACK TO INDEX

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21. Checking Starter Motor Pinion Clearance

a. Preferred Method (Fig. 6-20)

1. Remove starter motor from car as described in Note 25a.

2. Energize solenoid by applying 6 volts between solenoid "S" terminal and ground.

CAUTION: Do not use more than 6 volts or motor will operate. As a further precaution, connect a heavy jumper wire from the solenoid motor terminal to ground.

3. After energizing solenoid, press on clutch, Fig. 6-20, to take up movement.

4. Push pinion away from stop retainer as far as possible and use feeler gage to check clearance between starter motor pinion and pinion stop retainer, Fig. 6-20. Clearance should be .010 inch to .140 inch when pinion is in cranking position.

b. Alternate Method (Fig. 6-20)

If a six volt battery is not available, pinion clearance may be checked with a 12-volt battery in the following manner:

1. Remove starter motor from car as described in Note 26a.

2. Disconnect the motor field coil connector from the solenoid motor terminal and insulate it carefully.

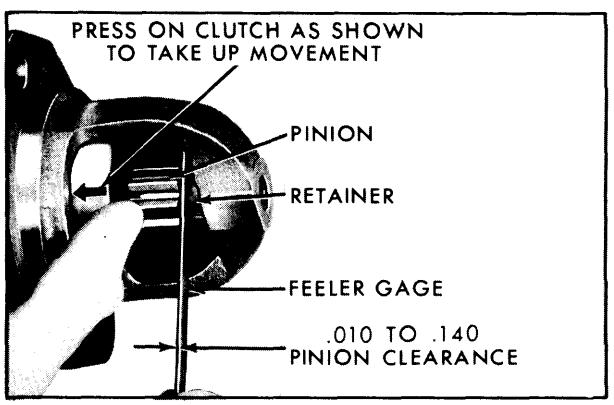


Fig. 6-20 Checking Pinion Clearance

3. Connect a 12 volt battery from the solenoid switch terminal to the solenoid frame.

Momentarily connect a jumper lead from the solenoid motor terminal to the solenoid frame. This will shift the pinion into cranking position and hold it there until the battery is disconnected.

5. After energizing solenoid, press on clutch, Fig. 6-20, to take up movement.

6. Push pinion away from stop retainer as far as possible and use feeler gage to check clearance between starter motor pinion and pinion stop retainer, Fig. 6-20. Clearance should be .010 inch to .140 inch when pinion is in cranking position.

(NOTE: Pinion clearance cannot be adjusted. If clearance is incorrect, disassemble starter motor and check for excessive wear of solenoid linkage, shift lever mechanism or improper assembly of these parts. All worn parts must be replaced.)

22. Checking Inoperative Starter Motor

If starter motor cranks engine slowly or not at all, check battery, battery terminals and connections, ground cable, and battery-to-starter motor cable. Corroded, frayed, or broken cables should be replaced, and loose or dirty connections corrected.

The overrunning clutch should withstand 80 to 85 foot-pounds torque without slipping. The pinion should turn freely and smoothly in the overrunning direction. The solenoid switch contacts should be checked for burned conditions, and the contact disc and terminal studs should be replaced if necessary.

Inspect brushes and commutator. Brushes should form a good contact with commutator and have the correct spring tension. If there are burned bars in the commutator, it may indicate open circuited armature coils that may prevent proper cranking. Inspect soldered connections at commutator rise bars, and resolder any damaged connections.

Tight or dirty bearings will reduce armature speed or prevent the armature from turning. A worn bearing, bent shaft, or loose pole shoe will allow armature to drag, causing slow speed or failure of the armature to rotate. Check for these conditions.

BACK TO INDEX

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SERVICE INFORMATION
STARTER

23. Starter Motor Circuit

The starter motor is engaged when the ignition key is turned to the extreme right position. Engagement is obtained by means of a solenoid, Fig. 6-21 attached to the starter housing. The solenoid first engages the starter pinion with the flywheel gear and then closes the main switch so that the battery current is delivered to the starter motor.

The starter solenoid is drawn into the engaged position by both the pull-in coil and the hold-in coil, and held in position by the hold-in coil only, Fig. 6-21. The contact bar at the end of the solenoid completes a direct circuit between the battery and the starter motor, energizing the starter motor and shorting out the pull-in coil.

The current consumption of the solenoid switch should be 41-47 amperes at 10 volts for both windings, and 14.5 - 16.5 amperes at 10 volts for the hold-in winding alone.

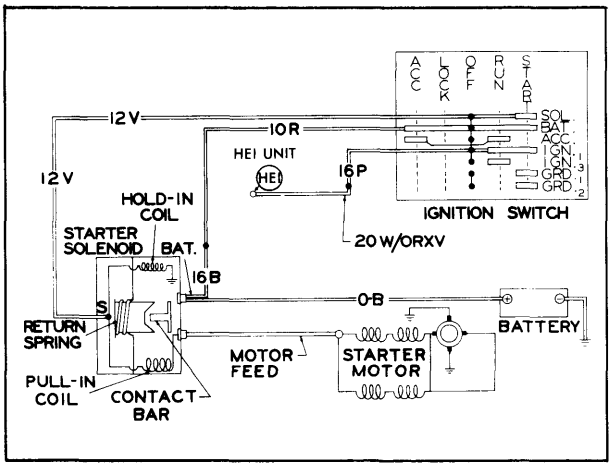


Fig. 6-21 Starting System Circuit

24. Starter Motor Maintenance

When the starter motor is disassembled for service, apply a light coating of lubricant on the bushings in the end bearings. Avoid excessive lubrication, as this might force lubricant out onto the commutator where it would gum and cause high resistance, resulting in poor starter motor performance. Never lubricate the commutator.

25. Starter Motor-Removal and Installation (Fig. 6-22)

a. Removal

1. Disconnect negative battery cable at battery.
2. On Eldorados, disconnect starter harness multiple connector at right rear of engine.
3. Raise front end of car.

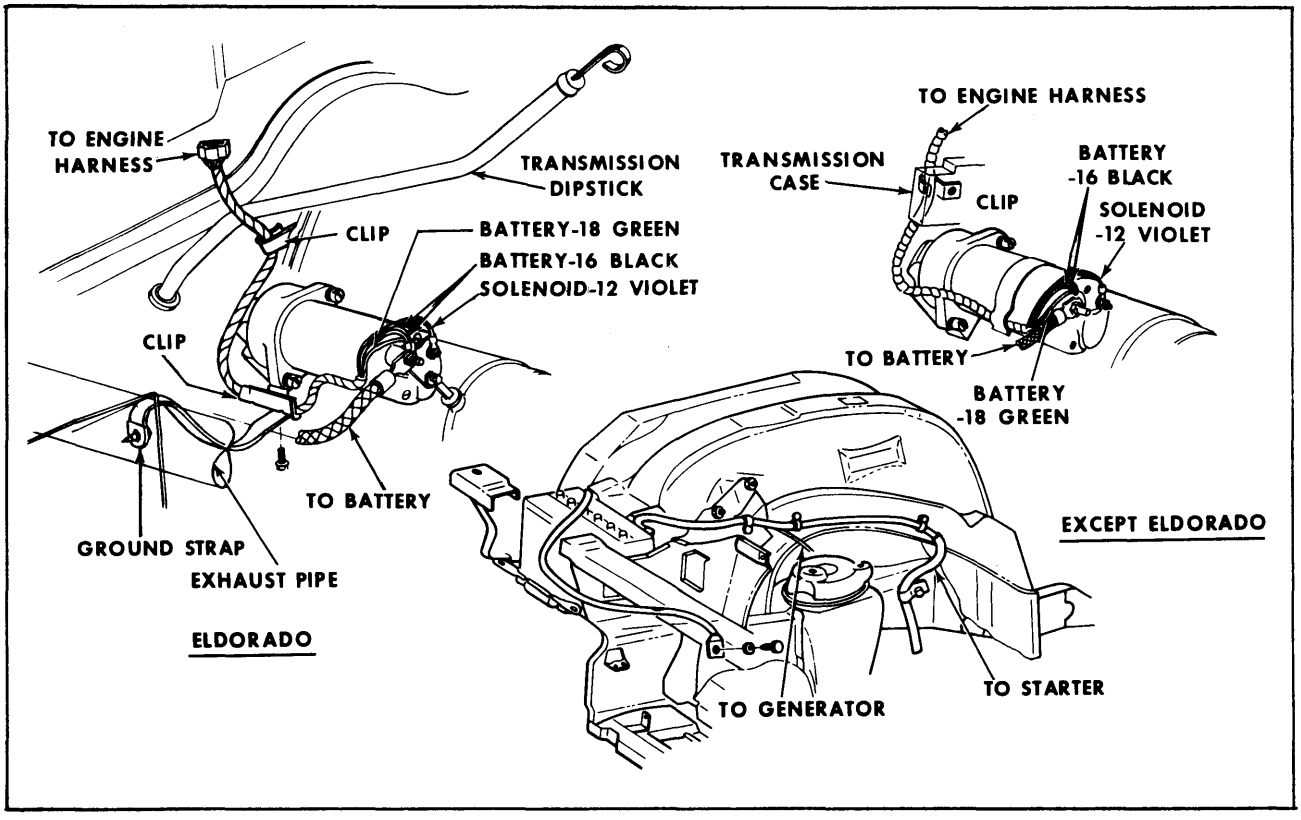


Fig. 6-22 Starter Motor Electrical Connections

BACK TO INDEX

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4. Disconnect battery lead at starter solenoid terminal (except Eldorado).
5. Remove spring clip securing wire to solenoid housing (Eldorado only).
6. Remove screw and nut securing support bracket to starter and crankcase (except Eldorado).
7. Remove two screws that hold starter motor.
8. Remove starter motor by pulling it forward; then toward right front wheel and up over steering linkage toward rear of car.

b. Installation

1. Position starter motor in proper location in flywheel housing.
2. Install two screws holding starter motor. Tighten screws to 46 foot-pounds, Fig. 6-22.

Note: Ground strap is placed under out board bolt. (except Eldorado).

3. Install starter motor support bracket and secure with screw and nut. Tighten screw to 12 ft. lbs. and nut to 6 ft. lbs. (except Eldorado).
4. On all except Eldorados, install starter motor harness to terminals on solenoid.
5. Install spring clip securing solenoid wires to solenoid housing and connect starter harness to underhood harness at right rear of engine (Eldorado only).
6. Lower car.
7. Connect negative battery cable to battery.

26. Starter Motor—Disassembly, Testing and Assembly

CAUTION: When the starter motor is disassembled for cleaning and inspection of parts, the overrunning clutch, armature, and fields should not be cleaned in a degreasing tank, or with grease dissolving solvents, since these would dissolve the lubricant in the clutch mechanism and would damage the insulation in the armature and field coils. Worn parts should be replaced, and the commutator should be turned down in a lathe if necessary.

a. Disassembly (Fig. 6-18)

1. Disconnect field coil connector from solenoid motor terminal.
2. Remove two screws and lockwashers that hold solenoid switch assembly to starter drive housing and remove solenoid and solenoid return spring by rotating solenoid assembly counterclockwise to release solenoid flange from center frame.
3. Remove two through bolts.
4. Remove commutator end frame and leather brake washer.
5. Remove center frame assembly.
6. Remove snap ring that holds shift lever pivot pin, using snap ring pliers, J-4880, and remove pivot pin from drive housing.
7. Remove plunger and shift lever assembly and armature assembly with overrunning clutch from drive end housing.
8. Remove overrunning clutch from armature shaft as follows:
   a. Slide thrust collar off end of armature shaft, Fig. 6-23.
   b. Slide a standard 3/8" pipe coupling or 5/8" deep socket onto shaft so end of coupling or socket butts against edge of retainer, Fig. 6-24. Tap end of coupling or socket with hammer, driving retainer toward armature and off snap ring.
   c. Remove snap ring from groove in shaft using pliers or other suitable tool. If snap ring is badly distorted during removal, it will be necessary to use a new one when assembling shaft.
   d. Slide retainer and clutch assembly from armature shaft.
9. To disassemble solenoid, proceed as follows:
   a. Remove two screws with neoprene washers and nut with neoprene washer from switch terminal.
   b. Remove contact cover.
   c. Remove push rod assembly.
   d. Inspect push rod assembly and contact studs for damage or wear. Contact assembly cannot be broken down further and must be replaced as a unit if found defective.
   e. To replace contact studs, hold stud while removing nut to be sure stud does not turn.

b. Visual Inspection

CAUTION: The overrunning clutch, armature, and fields should not be cleaned in a degreasing tank, or with grease dissolving solvents, since solvents would dissolve lubricant in clutch mechanism and damage the insulation in armature and field coils.

1. Test overrunning clutch action. Pinion should turn freely in the overrunning direction. Check pinion teeth to see that they have not been chipped, cracked or excessively worn. Replace clutch assembly if necessary.
2. Check bearings for signs of tightness, dirt or wear. Check for a bent armature shaft or a loose pole shoe screw.
3. Check brush holders to see that they are not

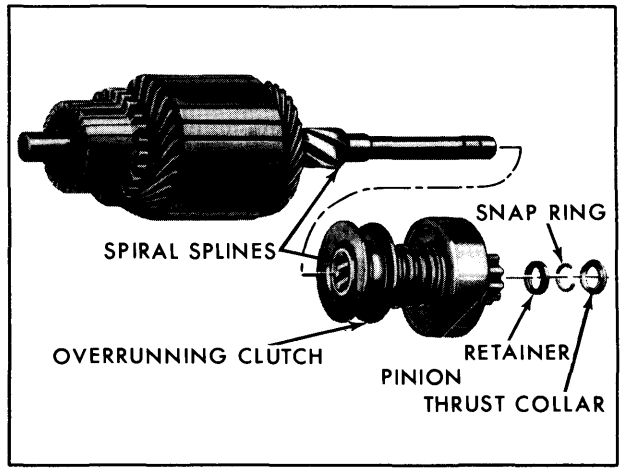


Fig. 6-23 Starter Armature Assembly

BACK TO INDEX
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deformed or bent so that brushes bind in their holders. Brush holders should be clean.

4. Check brushes for wear or damage in normal service. If worn down to one-half original length, brushes should be replaced.

5. See if full brush surface rides on the commutator when assembled, and if there is proper spring tension to give good firm contact. Replace weak brush springs.

6. Check brush leads and screws to be certain they are tight and clean. Clean leads, if necessary, and check tightness of screws.

7. Brush holding parts are replaced only if necessary, in the following manner:

a. Remove brush holder pivot pin.

b. Remove brush spring.

c. Replace brushes by removing attaching screw, installing a new brush and securing with attaching screw. Trade name will be visible when brushes are correctly installed.

d. Install brush spring by inserting it in slot in center frame.

e. Install insulated brush and grounded brush, and secure with pivot pin.

8. Check fit of armature shaft in drive housing and in commutator end frame. Shaft should fit snugly in both bushings. If bushing in drive housing is worn, it will be necessary to replace the bushing. If bushing in commutator end frame is worn, replace commutator end frame bushing.

9. Inspect leather brake washer for damage, and replace, if necessary.

c. Checking Armature for Shorts

1. Place armature in growler. Lock armature in position by securing clamp on the commutator. Turn ON-OFF switch on.

2. Rotate armature while holding steel strip that comes with the tester near the armature. Steel strip will vibrate in the area of a short circuit. Turn off switch.

d. Checking Armature for Opens

1. Inspect the points where conductors are joined to the commutator for loose connections. Poor connections can cause arcing and burning of the commutator.

2. If bars are not badly burned, resolder leads in riser bars. Have commutator turned down in a lathe.

e. Checking Armature for Grounds

Check for grounds with aid of a 110-volt test lamp.

1. Remove armature from armature tester and place on bench.

2. Place one test lamp lead on the commutator.

3. Touch other test lamp lead to armature core and then armature shaft. If lamp lights, the armature is grounded.

If the commutator is worn, dirty or out of round, a ground condition may result. If a ground is indicated, have commutator turned down in a lathe.

f. Checking Field Coils for Grounds

Check field coils for grounds and opens, using 110-volt test lamp.

a. Connect one lead of test lamp to motor feed terminal and other to any clean surface of field frame. Lamp should not light.

If lamp lights, field coils are grounded and must be replaced.

g. Checking Field Coils and Insulated Brush Holder Leads

1. With center frame assembly positioned so that brush holders are on top, push upper motor feed terminal from center frame assembly.

2. Touch one test lamp lead to each of motor feed terminals. Lamp should light. If it does not light, there is an open in field coils and field coil assembly must be replaced.

3. If the lamp lights, perform Step 4 to check insulated brush holder leads.

4. Hold one test lamp lead to either motor feed terminal. Touch other lead in turn to two pigtail leads of insulated brushes. Lamp should light.

If lamp does not light in either instance, leads should be repaired by soldering. Be sure to install upper motor lead in grommet.

h. Assembly

1. To assemble solenoid, proceed as follows:

a. Install contact studs, holding studs while tightening nut to be sure stud does not turn.

b. Install push rod assembly.

c. Install contact cover with switch terminal stud through square hole. Secure with two screws with plastic

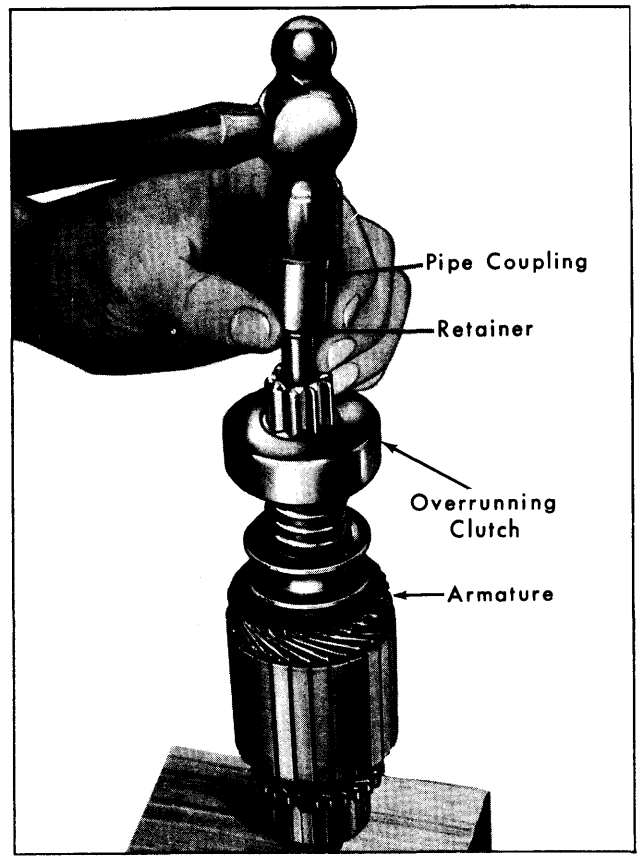


Fig. 6-24 Removing Overrunning Clutch

BACK TO INDEX

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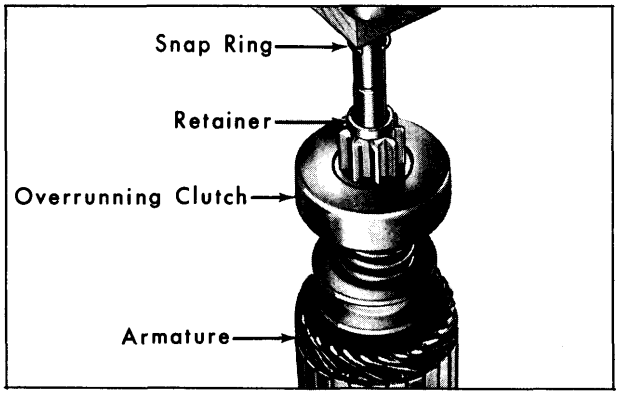


Fig. 6-25 Installing Snap Ring on Shaft

washers and lock nut with plastic washer on switch terminal stud.

2. Assemble overrunning clutch to armature shaft as follows:

a. Lubricate drive end of armature shaft with a few drops of SAE 30W oil.

b. Slide clutch assembly onto armature shaft with pinion outward, Fig. 6-24.

c. Slide retainer onto shaft with cupped surface facing end of shaft, Fig. 6-24.

d. Stand armature on end of a wood surface with commutator down. Position snap ring on upper end of shaft and hold in place with either a piece of wood or a 7/16" socket. Tap socket or block with hammer to force snap ring on end of shaft, Fig. 6-25. Slide snap ring down to the second groove.

e. Assemble thrust collar on shaft with shoulder next to snap ring, Fig. 6-26.

f. Position retainer and thrust collar next to snap ring. Using two pairs of pliers, grip retainer and thrust collar and squeeze until snap ring is forced onto retainer, Fig. 6-26.

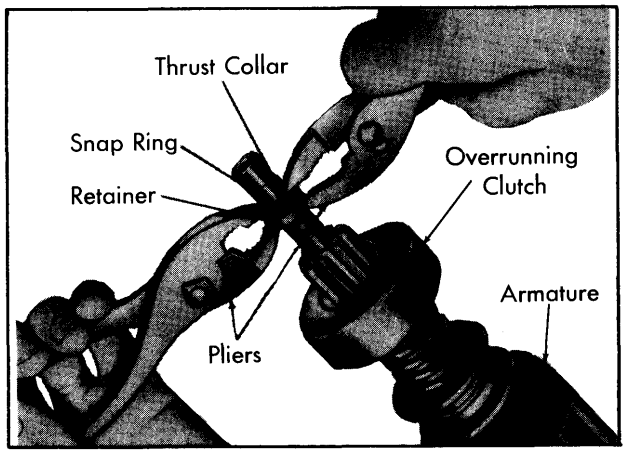


Fig. 6-26 Installing Snap Ring on Retainer

3. Place a small quantity of high melting point grease in drive end housing grease retainer.

4. Position legs of shift lever assembly in grooves of overrunning clutch. Install armature and overrunning clutch assembly into drive end housing, making certain that thrust washer is in place on end of shaft.

5. Install shift lever pivot pin into recess in housing and secure with snap ring, using Snap Ring Pliers, J-4880.

6. Mount starter in a vise and install solenoid return spring and solenoid switch assembly. Secure with two attaching screws and lock washers.

7. Apply a non-hardening sealing compound to area where center frame will contact solenoid case flange.

8. Install center frame assembly on drive end housing by starting assembly over armature, spreading brush holders apart to engage commutator and mating dowel pin on frame with dowel pin hole in drive end housing.

9. Place a small quantity of high melting point grease on bushing in commutator end frame.

10. Place leather brake washer on armature shaft.

11. Slide commutator end frame on shaft and secure with two through bolts.

12. Install field coil terminal connector on solenoid motor terminal, securing with self-tapping screw and star washer.

27. Fusible Links

Fusible links are used to protect the engine primary harness at the starter motor. Fusible link wire is usually 4-6 wire gage sizes smaller than the circuit it protects. Should the fusible link wire break as the result of a short circuit, first find the source of the short circuit and repair. Because of the smaller diameter wire, a small change in the length of the fusible link would result in a large change in the "fuse rating" of the wire. For this reason it is important to replace damaged fusible links with a new piece of fusible link wire, cut to the correct length, which is available from various sources.

Complete information on fusible links is contained in section 12 of this manual.

BACK TO INDEX
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THEORY OF OPERATION
HIGH ENERGY IGNITION SYSTEM

Distributor

An aluminum alloy ignition distributor (H.E.I.) Fig. 6-27, is mounted on the top left front of the engine. It is fully automatic in operation, and driven by an alloy iron gear that meshes with a gear that is integral with the camshaft. The distributor cam rotates in a clockwise direction when viewed from above. The firing order is 1-5-6-3-4-2-7-8.

(NOTE: Refer to Electronic Fuel Injection portion of this section if car is so equipped.)

The High Energy Ignition System, Fig. 6-27 features a built-in ignition coil, an electronic module and a magnetic pick-up assembly. The module and pick-up assembly take the place of the conventional contact points and condenser.

The HEI system is designed to provide high output secondary voltages. The system is energized by one wire from the ignition switch. The eight spark plug wires complete the entire external wiring circuit.

A terminal is provided in the cap to which a tachometer can be connected. A connector plugs into the cap to connect the pick-up assembly and electronic module to the ignition coil.

Ignition Coil

In the HEI system, Fig. 6-28, the ignition coil is built into the distributor cap. The coil is somewhat smaller physically than a conventional coil, but has more primary and secondary windings. It is built more like a true transformer with the windings surrounded by the laminated iron core. A conventional coil has the iron core inside the windings. Although the HEI coil operates in basically the same way as a conventional coil, it is more effective in generating higher secondary voltage when the primary circuit is broken.

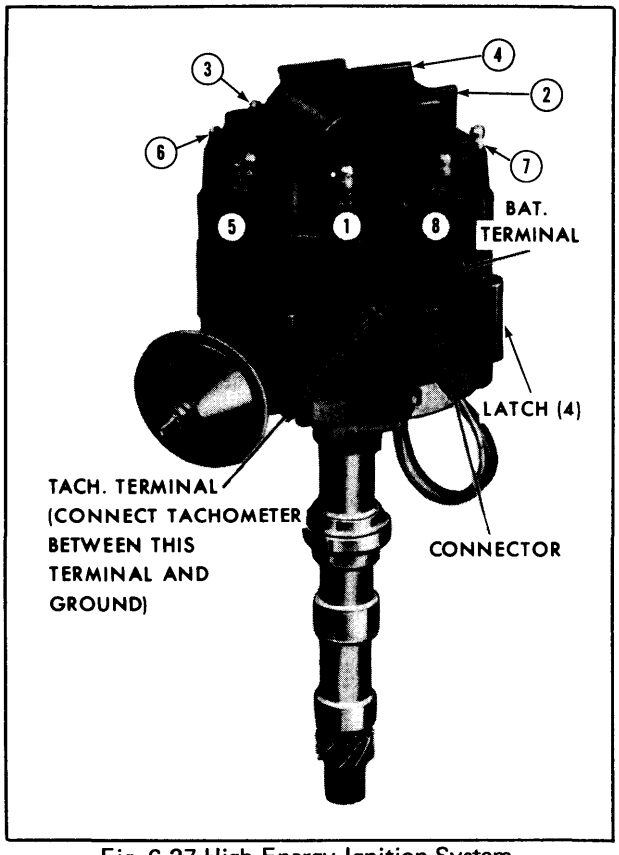


Fig. 6-27 High Energy Ignition System

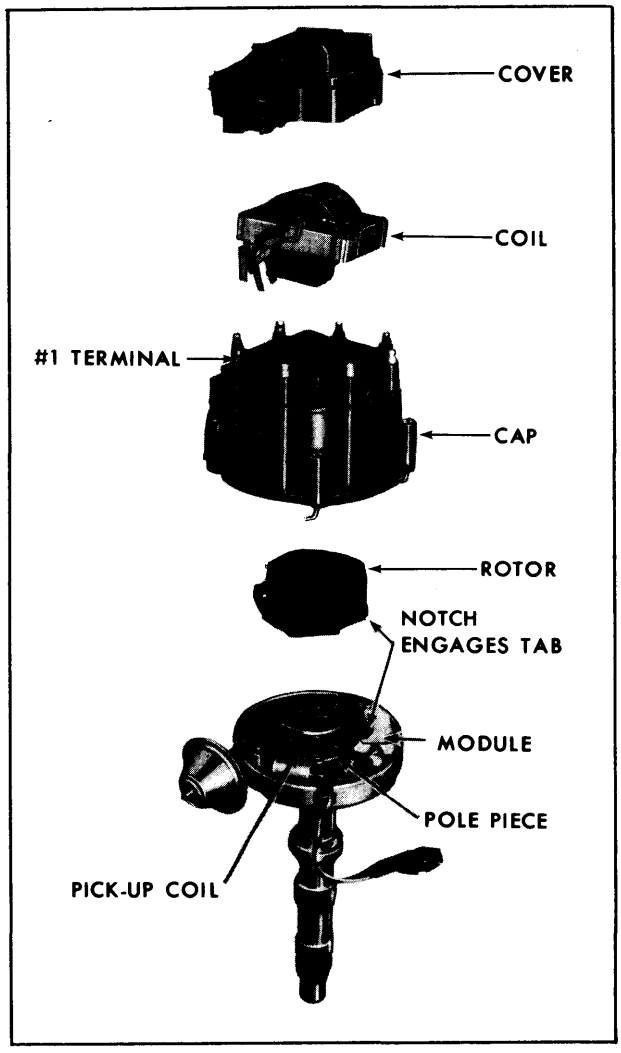


Fig 6-28 High Energy Ignition – Disassembled

Centrifugal Advance

At idle, the spark is timed to occur just before the piston reaches top dead center (6° B.T.D.C.) on the compression stroke. As engine speed increases, it is necessary to fire the spark plug somewhat earlier, to provide sufficient time for the mixture to burn and deliver its power to the piston. To provide this advance, a centrifugal advance mechanism is used. The mechanism consists of two weights that move out against spring tension as engine speed increases. This movement is transmitted to the breaker cam causing the cam to advance relative to the drive shaft. Therefore, the timing of the cylinders varies from no

BACK TO INDEX

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advance at low engine speeds to full advance at high speeds as the weights reach the limits of their travel. The weights and springs are calibrated to provide the best possible performance at wide open throttle with 91 (research) octane fuel.

Vacuum Advance

During part throttle conditions a partial vacuum is developed in the intake manifold. Since less air and fuel are admitted, the mixture is less highly compressed. Under these conditions, the mixture will burn slower and, in order to achieve full power, the spark must be advanced. The vacuum sensitive advance mechanism, Fig. 6-28, consists of a spring loaded diaphragm connected by linkage to the pole piece. The spring loaded side of the diaphragm is connected to the carburetor. 6-29. With the throttle closed, no vacuum is available and there is no vacuum advance. As the throttle is opened it passes the vacuum port allowing the line and vacuum advance unit to be evacuated. With the diaphragm chamber evacuated, the diaphragm moves against spring pressure to rotate the breaker plate allowing the cam to open and close the points earlier in the cycle.
spring pressure to rotate the pick-up coil and pole piece for alignment earlier in the cycle.

Electronic Module

The electronic module is a solid state unit containing five complete circuits which control spark triggering, switching, current limiting, dwell control and distributor pick-up. Dwell angle is controlled by a transistor circuit within the module and is varied in direct relation to engine speed.

Pick-Up Coil Assembly

The pick-up coil assembly consists of the following:

1. A rotating timer core with eight external teeth which is turned by the distributor shaft.
2. A stationary pole piece with eight internal teeth.
3. A pick-up coil and magnet which are located between the pole piece and a bottom plate.

Operation

The pick-up coil is connected to transistors in the electronic module. The electronic module is connected to the primary windings in the coil. As the distributor shaft turns the timer core teeth out of alignment with the teeth of the pole piece a voltage is created in the magnetic field of the pick-up coil.

The pick-up coil sends this voltage signal to the electronic module, which determines from RPM when to start current building in the primary windings of the ignition coil.

Each time the timer core teeth align with the pole piece teeth the pick-up coil magnetic field is changed creating a different voltage. The pick-up coil sends this different voltage signal to the electronic module which electronically shuts off the ignition coil primary circuit. This in turn collapses the coil magnetic field, induces high secondary voltage and fires one spark plug.

The electronic module delivers full battery voltage to the ignition coil which is limited to five to six amperes. There is no primary resistance wire in the HEI system. The electronic module triggers the closing and opening of the primary circuit instantaneously with no energy lost due to breaker point arcing or capacitor charging time lag. The capacitor in the HEI unit functions only as a radio noise suppressor.

This instantaneous and efficient circuit triggering enables the HEI system to deliver up to approximately 35,000 volts through the secondary wiring to the spark plugs.

Because of this higher voltage the HEI system has 8MM diameter spark plug wires with silicone insulation. The silicone wire is gray in color and heat resistant. Silicone insulation is soft, however, and must not be mishandled.

28. Analyzing H.E.I. System Problems

Careful adherence to the following procedures will lead to the location and correction of High Energy Ignition system problems.

Normally only a portion of the procedures need be performed.

Before starting the detailed procedure:

1. Make sure that wiring connector is properly attached to connector at side of distributor cap.
2. Make sure that all spark plug leads are properly connected at plugs and at distributor terminals.

Trouble in the ignition system will show up as one of the following conditions:

a. Engine will not start.
b. Engine starts but runs roughly.

a. Engine will not Start

1. Connect voltmeter between "BAT" terminal lead on distributor connector and ground.
2. Turn ignition switch ON.
3. If voltage is zero, there is an open circuit in the 18 pink wire between the distributor and the bulkhead connector; or in the 12 pink wire between the bulkhead connector and the ignition switch; or in the 10 red wire between the ignition switch and the starter solenoid. Repair as required.
4. If reading is battery voltage, hold one spark plug lead with insulated pliers approximately 1/4 inch away from a dry area of engine block while cranking engine.
5. If sparking occurs, trouble is not in distributor. Check spark plugs. Refer to Page 6-62 for fuel system diagnosis.
6. If sparking does not occur, proceed to Note 29.

b. Engine Starts But Runs Roughly

1. Check for proper fuel delivery.
2. Check all vacuum hoses for leakage.
3. Visually inspect and listen for sparks jumping to ground or to other plug wires.
4. Check ignition timing.
5. Check centrifugal advance mechanism for proper operation.

BACK TO INDEX

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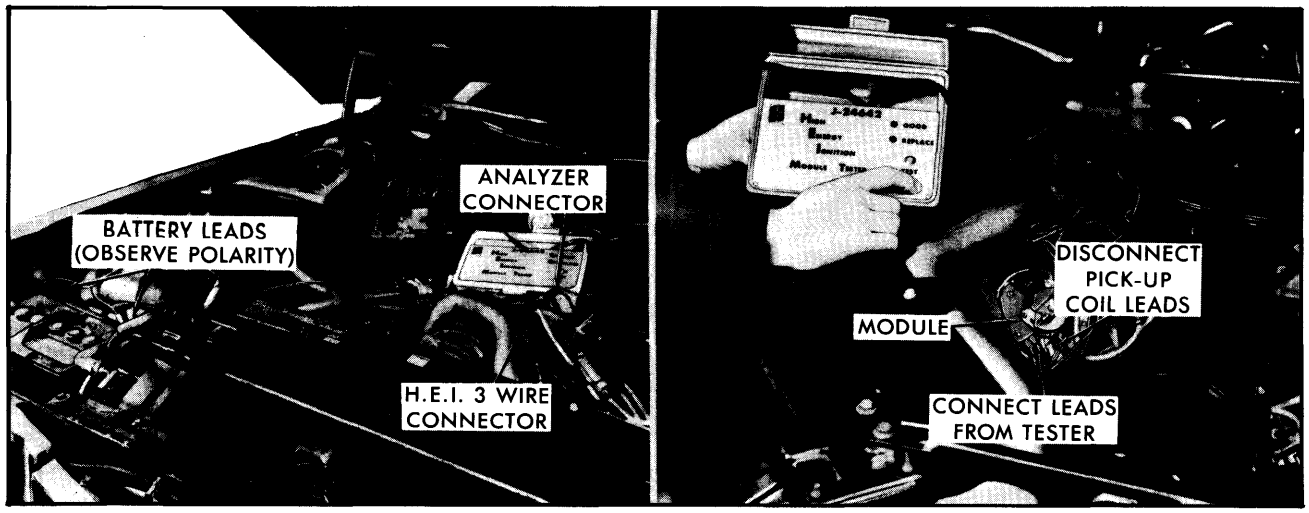


Fig. 6-29 Testing HEI Module

6. Remove all spark plugs and check for malfunctions such as improper gap, fouling, cracked insulators (inside and out), etc.

7. If no malfunctions are found, proceed to Note 29.

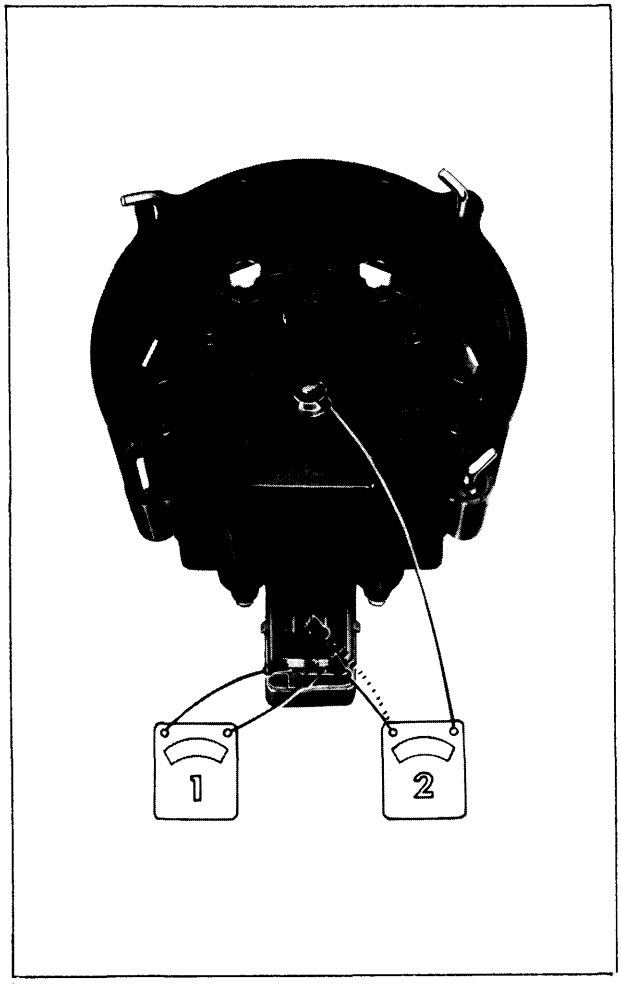


Fig. 6-30 Checking HEI Ignition Coil

29. H.E.I. Component Checks

1. Disconnect 3-wire connector from distributor cap.

2. Connector analyzer J-24642 to 3-wire connector, Fig. 6-29.

3. Connect analyzer leads to battery, Fig. 6-29. Observe polarity.

4. Push analyzer button while cranking engine. If green light comes on, module and pickup coil are both good. The ignition coil is probably malfunctioning and should be checked with an ohmmeter as follows:

a. Remove cap and coil assembly by removing wiring harness connector and battery lead and turning four cap to housing latches.

b. Connect ohmmeter with one lead to the "BAT" terminal and the second lead to the "TACH" terminal as shown in position 1 of Fig. 6-30.

c. Reading should be zero or nearly zero. If not, replace coil.

d. Connect ohmmeter both ways as shown in position 2 of Fig. 6-30. Use high scale. Replace coil only if both readings are infinite or show an open circuit.

e. Connect ohmmeter with one lead to the "TACH" terminal and the second lead to the coil secondary output terminal as shown in position 2 of Fig. 6-30. Use middle or high scale. Reading should not be infinite. If reading is infinite, replace coil.

5. If red light comes on in step 3, either the module or the pickup coil is malfunctioning. Lift distributor cap and connect green and white analyzer wire clips to module. (These analyzer leads provide an alternating current pulse, just as good pickup coil does.)

6. Push analyzer button. If green light now comes on, the pickup coil is malfunctioning. If red light still comes on, the module is probably malfunctioning.

7. Replace malfunctioning component and retest.

BACK TO INDEX

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30. Distributor Testing (Except EFI)

CENTRIFUGAL ADVANCE		VACUUM ADVANCE	
Distri-butor RPM	Distri-butor Advance	Inches of Mercury	Distri-butor Advance
200	0°	4½"	0°
330	-¼° to 0°	5½"	0° to 2°
450	-½° to 2½°	8"	4° to 6°
600	2½° to 5°	11"	8° to 10°
1400	5° to 7°	15"	12½° to 14½°
2500	8° to 10°	16"	13½° to 14½°
3000	7½° to 10°		

All Federal and California exc. Eldorado

CENTRIFUGAL ADVANCE		VACUUM ADVANCE	
Distri-Butor RPM	Distri-butor Advance	Inches of Mercury	Distri-butor Advance
200	0°	5½"	0°
330	-¼° to 0°	6½"	0° to 2°
450	-½° to 2½°	8"	2° to 4°
600	2½° to 5°	13"	9° to 10½°
1400	5° to 7°	13½"	9½° to 10½°
2500	8° to 10°		

California Eldorado only

SERVICE INFORMATION

The HEI system is designed to be free from routine maintenance. If component part replacement should become necessary, however, several items specific to the HEI system should be noted.

Electronic Module

The electronic module is serviced by complete replacement only. When replacing the module a liberal coating of special silicone grease must be applied to the metal mounting surface on which the module will be installed. If this grease is not applied the module will not cool properly which can cause the module to malfunction. A tube of this special silicone grease is supplied with each replacement module.

Spark Plug Wires

The 8 millimeter silicone insulation spark plug wire boots seal tightly to the spark plugs. Twist the boot about a half turn in either direction to break the seal before pulling on the boot to remove the wire.

CAUTION: Do NOT remove spark plug wires with the engine running. The higher secondary voltage is capable of jumping an arc of greater distance and could cause an electric shock.

Timing Light Connections

Timing light connections should be made in parallel using an adapter at the distributor number one terminal. Avoid puncturing the boots or cable covers.

Tachometer Connections

In the distributor cap connector is a "tach" terminal. Connect the tachometer to this terminal and to ground. Some tachometers must connect from the "tach" terminal to the battery positive (+) terminal. Follow tachometer manufacturer's instructions.

CAUTION: Grounding "tach" terminal could damage the H.E.I. electronic module.

Other Test Equipment

Oscilliscopes require special adaptors. Distributor machines require a special amplifier. The equipment manufacturers have instructions and details necessary to modify test equipment for HEI diagnosis.

Vacuum and Centrifugal Advance Specifications

Vacuum and centrifugal advance specifications are shown in Note 30.

Generator Diode

A diode is included in the brown wire of the harness near the generator tell tale lamp. In appearance it is quite similar to the starter interlock diode. It is located near the top of the radio heat sink. The purpose of the diode is to prevent feed back through the generator tell tale lamp brown lead wire to the HEI module. Without the diode the approximate 2.7 volts from this feed back would cause engine dieseling.

31. Ignition Timing Adjustment

Ignition timing may be adjusted by either of two methods; 1. with conventional strobe light timing equipment or, 2. with a probe type timing advance meter. Both methods are dscribed in this note.

a. Strobe Light Timing

1. Adjust distributor clamp nut to allow distributor to be turned by hand, but without excessive looseness.
2. Disconnect vacuum advance unit hose at distributor and place a piece of tape over end of hose. This is important, as a manifold leak will affect timing adjustments.
3. Insert a timing light adapter between the number 1 spark plug and its lead wire.

BACK TO INDEX

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(NOTE: If spark plug adapters are not available disconnect number 1 spark plug wire and connect timing light to plug lead. Time engine on seven cylinders. Do not force pins or wires thru spark plug wire nipple.)

4. Connect a suitable timing light to adapter.

(NOTE: Make sure that timing marks and scribe marks are clean.)

5. Disconnect and plug A.L.C. hose on cars so equipped.

6. Connect tachometer to engine and set parking brake securely. Place transmission selector lever in neutral or park position.

7. Start engine.

8. With engine warm and idle speed at 600 rpm or less, observe timing light flashes on pulley in relation to notches on front cover. Set timing to 6 degrees before top dead center, Fig. 6-31.

9. Recheck idle speed with vacuum advance hose connected and reset to 600 RPM if required.

10. Position vacuum hose clamp in properly and tighten clamp nut to 18-foot-pounds, and recheck timing to make sure that it did not change.

11. Disconnect tachometer and timing light, and remove adapter from engine.

b. Timing Advance Meter

1. Adjust distributor clamp nut to allow distributor to be turned by hand, but without excessive looseness.

2. Disconnect vacuum advance unit hose at distributor and place a piece of tape over end of hose. This is important, as a manifold leak will affect timing adjustments.

3. Disconnect and plug A.L.C.

4. Connect power supply for timing meter to battery. Observe correct polarity, Fig. 6-31.

5. Install ignition pickup clip over No. 1 spark plug wire, Fig. 6-31. Be sure jaws are clean and locking button is pressed forward to close jaws firmly.

6. Install magnetic pickup in receptacle of timing tab and press down firmly. Fig. 6-31.

(NOTE: Pickup should be as close to pulley surface as possible without making contact.)

7. Make sure that all leads to advance meter are out of way of moving parts and exhaust manifold.

8. Turn power switch ON and timing-advance switch to TIMING position.

9. Start engine.

10. With engine warm and idle speed to 600 RPM or less, observe ENGINE DEGREES meter and set timing to 6° before top dead center (+ 6 degrees on meter).

11. Tighten clamp nut to 18 foot-pounds, and recheck timing to make sure that it did not change.

12. Remove tape from vacuum advance hose and connect hose to vacuum advance unit. Position hose clamp properly.

13. Recheck idle speed with vacuum advance hose connected and reset as required.

14. Disconnect timing advance meter connection from engine.

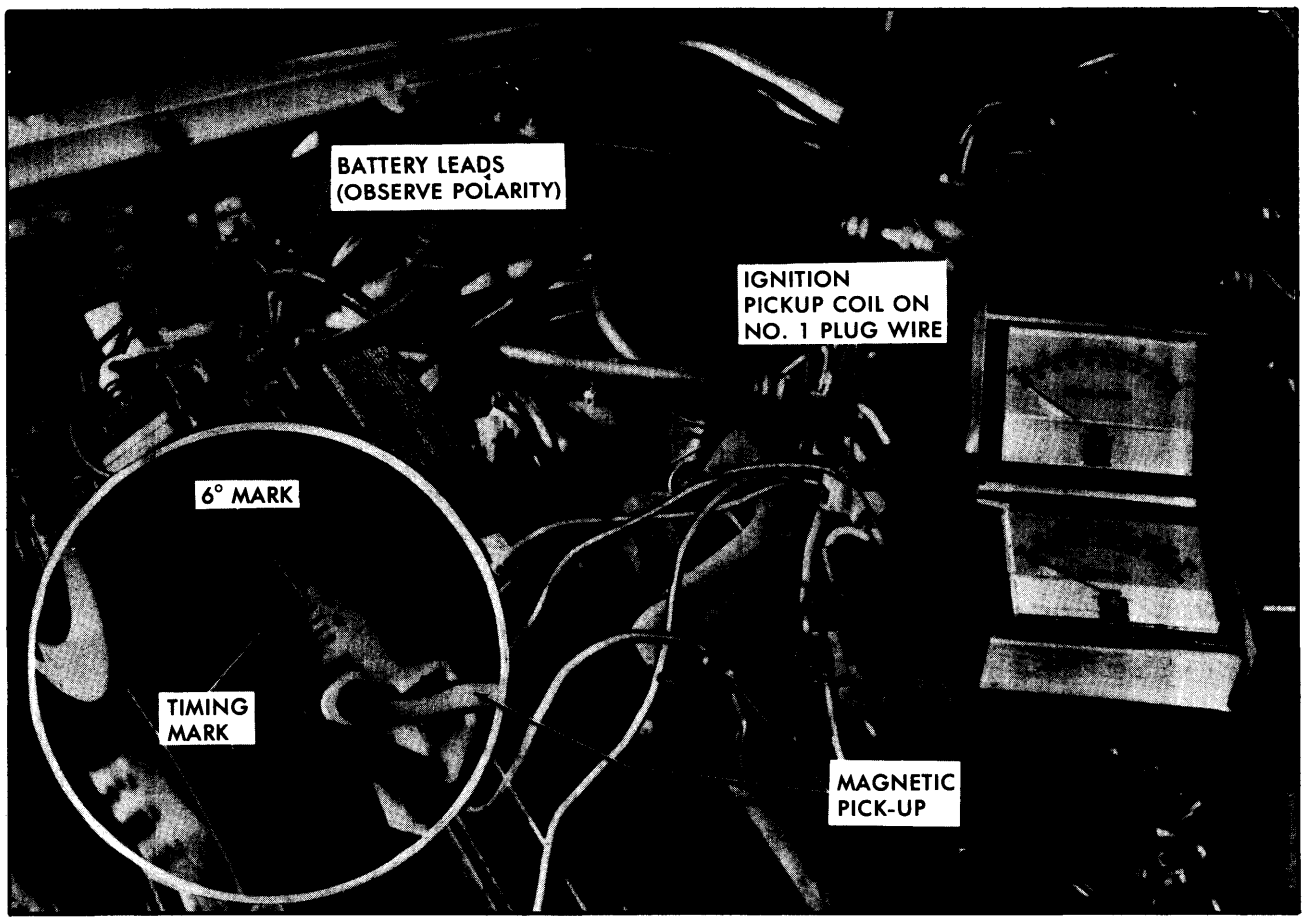


Fig. 6-31 Ignition Timing Adjustment

BACK TO INDEX

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32. Distributor Removal and Installation (Except EFI)

a. Removal

1. Disconnect wiring harness connectors at side of distributor cap.
2. Disconnect speed sensor connector at distributor trigger.
3. Remove distributor cap and position out of way.
4. Disconnect vacuum advance hose from vacuum advance mechanism.
5. Scribe a mark on the engine in line with rotor. Note approximate position of distributor housing in relation to engine.
6. Remove distributor hold-down nut and clamp.
7. Lift distributor from engine.

b. Installation

1. Install distributor using same procedure as for standard distributor.
2. Install distributor hold-down clamp and snugly install nut.
3. Move distributor housing to approximate position relative to engine noted during removal.
4. Position distributor cap to housing with tab in base of cap aligned with notch in housing and secure with four latches.
5. Connect wiring harness connector to terminals on side of distributor cap. Connector will fit only one way.
6. Adjust ignition timing to 6° B.T.D.C. using the procedure described in Note 31.

33. Distributor Disassembly and Assembly (Except EFI)

a. Disassembly

1. Remove distributor as described in note 32a.
2. Remove rotor from distributor shaft by removing two screws.
3. Remove two advance springs and advance weights.
4. Remove two screws holding module to housing and move module to a position where connector may be removed from "B" and "C" terminals.
5. Remove wires from "W" and "G" terminals of module.
6. Remove roll pin from drive gear.

CAUTION: Distributor gear should be supported in such a way that no damage will occur to distributor shaft while removing pin.

7. Remove gear, shim and tanged washer from distributor shaft. Remove any burrs that may have been caused by removal of pin.
8. Remove distributor shaft from housing.
9. Remove three screws securing pole piece to housing and remove pole piece, magnet and pick-up coil.
10. Remove lock ring at top of housing and remove pick-up coil retainer and felt washer.

(NOTE: No attempt should be made to service the shaft bushings in the housing.)

11. Remove vacuum advance mechanism by removing two screws.
12. Disconnect capacitor lead and remove capacitor by removing one screw.
13. Remove wiring harness from distributor housing.

b. Assembly

1. Position vacuum advance unit to housing and secure with two screws.
2. Position felt washer over lubricant reservoir at top of housing.
3. Position pick-up coil retainer to housing with vacuum advance arm over actuating pin of vacuum advance mechanism. Secure with lock ring.
4. Install pick-up coil magnet and pole piece. Loosely install three screws holding pole piece. See Fig. 6-32 for correct identification.
5. Install distributor shaft and rotate to check for even clearance all around between pole piece and shaft projections.
6. Move pole piece to provide even clearance and secure with three screws.
7. Install tanged washer, shim and drive gear (teeth up) to bottom of shaft. Align drive gear and install new roll pin.
8. Position capacitor to housing and loosely install one mounting screw.
9. Install connector to "B" and "C" terminals on module with tab on top.
10. Apply special silicone lubricant liberally to bottom of module and secure with two screws.
11. Position wiring harness with grommet in housing notch.
12. Connect pink wire to capacitor stud, and black wire to capacitor mounting screw. Tighten screw.
13. Connect white wire from pick-up coil to terminal "W" of module.
14. Connect green wire from pick-up coil to terminal "G" of module.
15. Install centrifugal advance weights and springs.
16. Install rotor and secure with two screws.

CAUTION: Notch on side of rotor must engage tab on cam weight base.

17. Install distributor as described in Note 42b.

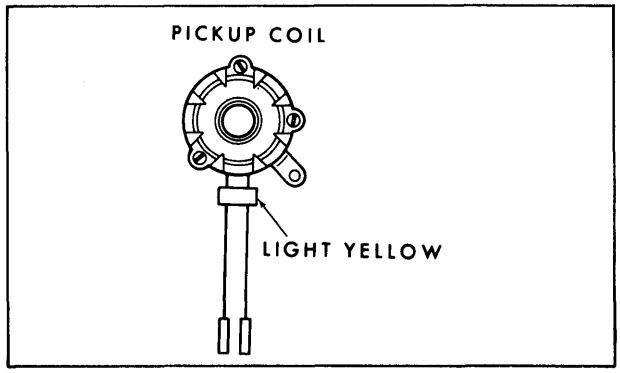


Fig. 6-32 Pickup Coil Identification

BACK TO INDEX

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34. Ignition Coil

a. Removal

1. Disconnect battery wire and harness connector from distributor cap.
2. Remove three screws securing coil cover to distributor cap.
3. Remove four screws securing ignition coil to distributor cap.
4. Remove ground wire from coil.
5. Push coil leads from under side of connectors and remove coil from distributor cap.

b. Installation

1. Position coil into distributor cap with terminals over connector at side of cap. See Fig. 6-33 for correct identification.
2. Push coil lead wires into connector on side of cap as follows: black (ground) in center; brown next to vacuum advance unit; pink opposite vacuum advance unit.
3. Secure ignition coil with four screws. Place ground wire under coil mounting screw.
4. Install coil cover onto distributor cap and secure with three screws.

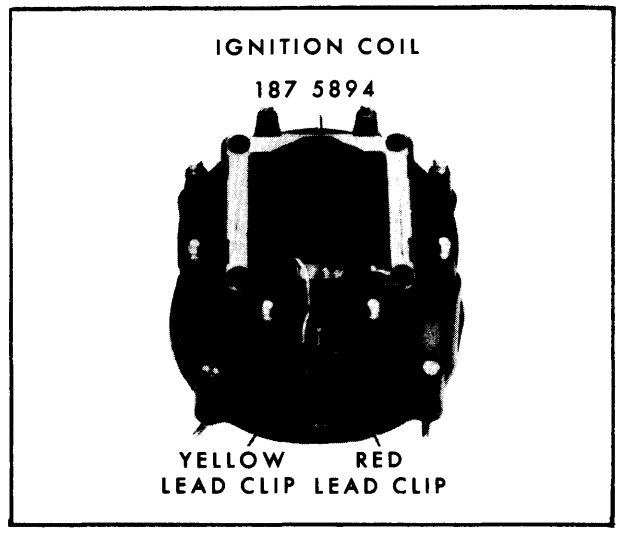


Fig. 6-33 Ignition Coil Identification

BACK TO INDEX
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THEORY OF OPERATION
GENERATOR (EXCEPT HEAVY DUTY)

Cadillacs are equipped with either of two generators, Fig 6-34. Standard equipment is a 63 ampere model which provides for normal electrical needs. Cars equipped with the Trailer Towing package (option YM7) use an 80 ampere model to satisfy the additional electrical loads of trailer towing operation. The 80 ampere generator is also available separately (option K97) for other uses where extra generator capacity is desired and is standard on the Limousine and Commercial Chassis (Series 6DF and 6ZZ).

All generators feature a solid state regulator that is mounted inside the generator slip ring end frame. All regulator components are enclosed into a solid mold, and this unit along with the brush holder assembly is attached to the slip ring end frame. The regulator voltage setting never needs adjusting, and no provision for adjustment is provided.

The generator rotor bearings contain a supply of lubricant sufficiently adequate to eliminate the need for periodic lubrication. Two brushes carry current through the two slip rings to the field coil mounted on the rotor, and under normal conditions will provide long periods of attention-free service.

The stator windings are assembled on the inside of a laminated core that forms part of the generator frame. A rectifier bridge connected to the stator windings contains six diodes, and electrically changes the stator a.c. voltages to a d.c. voltage which appears at the generator output terminal. Generator field current is supplied through a diode trio which also is connected to the stator windings. A capacitor, or condenser, mounted in the end frame protects the rectifier bridge and diode trio from high voltages, and suppresses radio noise.

No periodic adjustments or maintenance of any kind are required on the entire generator assembly.

A wiring circuit diagram is illustrated in Fig. 6-35. The basic operating principles are explained as follows.

When the switch is closed, current from the battery flows through the indicator lamp to the generator No. 1 terminal, through resistor R1, diode D1, and the base-emitter of transistor TR1 to ground, and then back to the battery. This turns on transistor TR1, and current flows through the generator field coil and TR1 back to the battery. The indicator lamp then turns on. Resistor R5 carries some of the indicator lamp current.

With the generator operating, a.c. voltages are generated in the stator windings, and the stator supplies d.c. field current through the diode trio, the field, TR1,

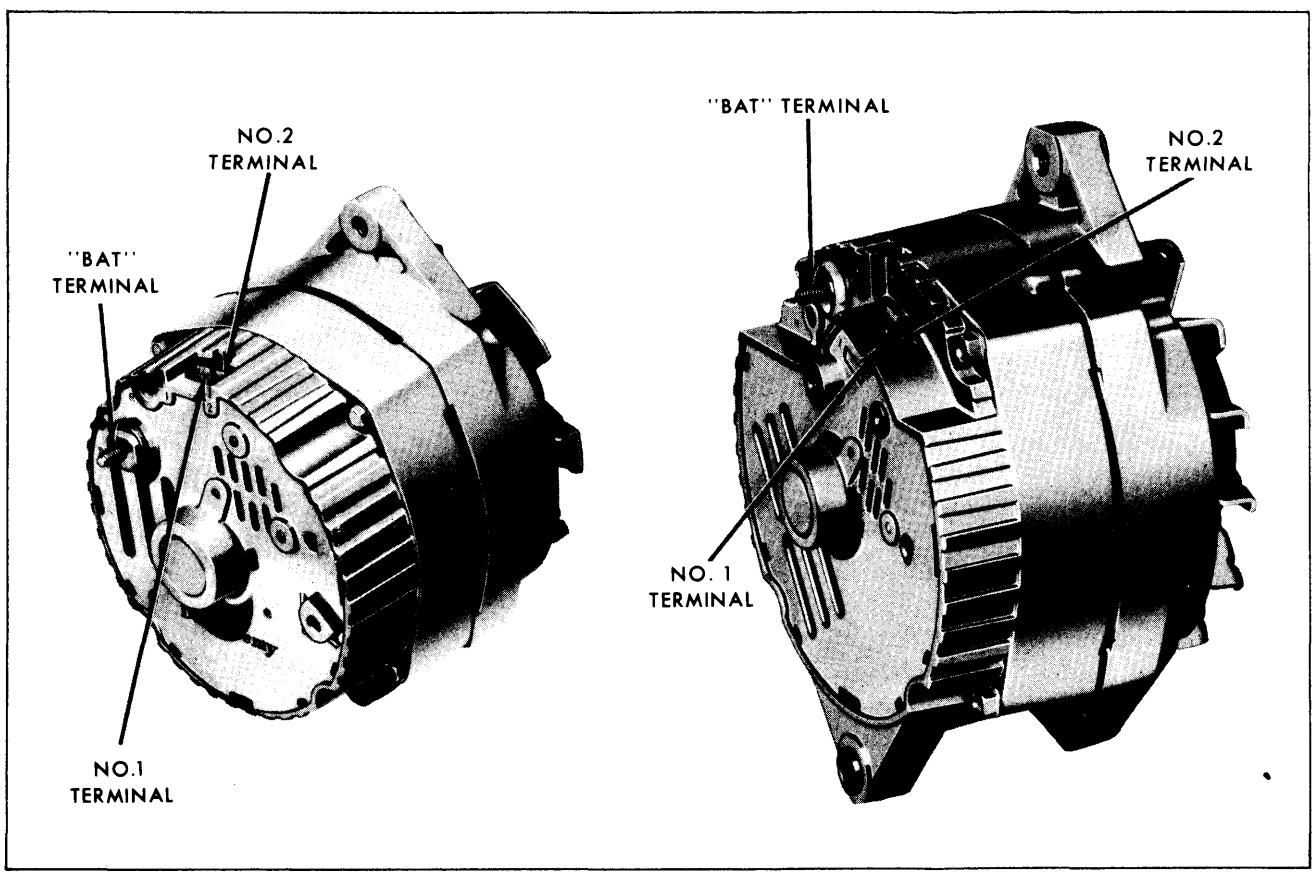


Fig. 6-34 Generators

BACK TO INDEX

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and then through the grounded diodes in the rectifier bridge back to the stator. Also, the six diodes in the rectifier bridge change the stator a.c. voltages to a d.c. voltage which appears between ground and the generator "BAT" terminal. As generator speed increases, current is provided for charging the battery and operating electrical accessories. Also, with the generator operating the same voltage appears at the "BAT" and No. 1 terminals, and the indicator lamp goes out to indicate the generator is producing voltage.

The No. 2 terminal on the generator is always connected to the battery but the discharge current is limited to a negligible value by the high resistances of R2 and R3. As the generator speed and voltage increase, the voltage between R2 and R3 increases to the point where zener diode D2 conducts. Transistor TR2 then turns on and TR1 turns off. With TR1 off, the field current and system voltage decrease, and D2 then blocks current flow, causing TR1 to turn back on. The field current and system voltage increase, and this cycle then repeats many times per second to limit the generator voltage to a preset value.

.Capacitor C1 smooths out the voltage across R3, resistor R4 prevents excessive current through TR1 at high temperatures, and diode D3 prevents high-induced-voltages in the field windings when TR1 turns off. Resistor R2 is a thermistor which causes the regulated voltage to vary with temperature, thus providing the optimum voltage for charging the battery.

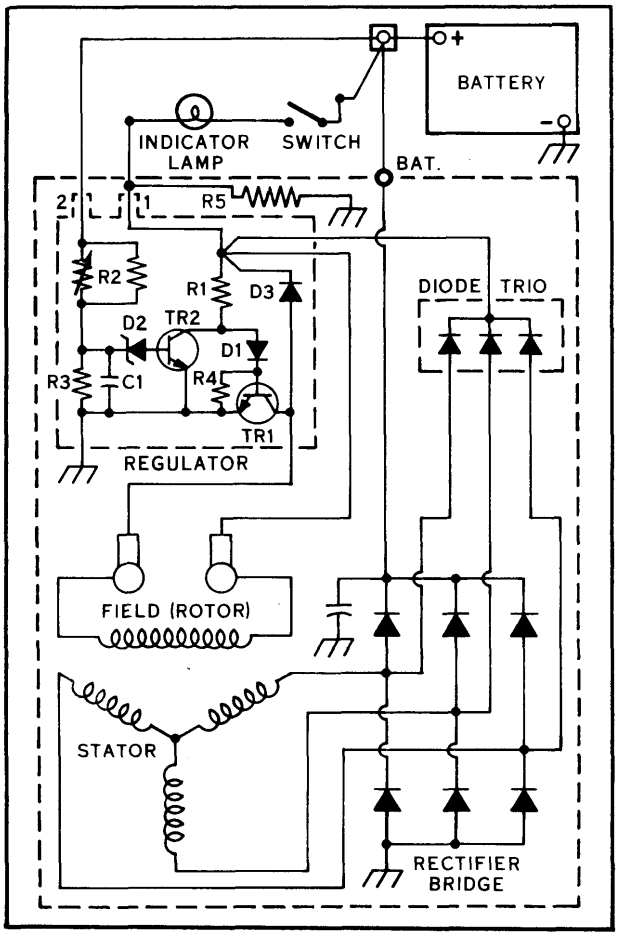


Fig. 6-35 Charging Circuit Wiring

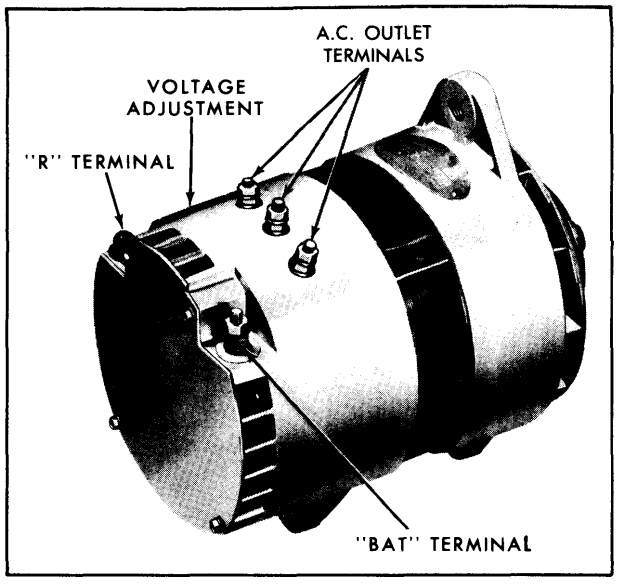


Fig. 6-36 Heavy Duty Generator

Heavy Duty Generator

The optional heavy duty integral charging system for the Commercial Chassis is illustrated in Fig. 6-36 and features a solid state regulator that is mounted inside the slip ring end frame. The regulator voltage setting can be adjusted externally by repositioning a voltage adjustment cap in the slip ring end frame. This feature is covered in detail in Fig. 6-48. Only one wire is needed to connect the Integral Charging System to the battery, along with an adequate ground return. To operate auxiliary equipment, three a.c. terminals are provided to which a transformer-rectifier combination may be connected for conversion to 110 volts d.c.

The rotor bearing in the slip ring end frame contains a supply of lubricant sufficiently adequate to eliminate the need for periodic lubrication. The drive end frame bearing is sealed on both sides and is serviced by complete replacement. Two brushes carry current through the two slip rings to the field coil mounted on the rotor, and under normal conditions will provide long periods of attention-free service.

The stator windings are assembled on the inside of a laminated core that forms part of the frame. Rectifier bridges connected to the stator windings each contain six diodes, and electrically change the stator a.c. voltages to a d.c. voltage which appears at the output terminal. Field current is supplied through a diode trio which also is connected to the stator windings. A capacitor, or condenser, mounted in the end frame protects the rectifier bridges and diode trio from high voltages, and suppresses radio noise.

The internal wiring diagram is illustrated in Fig. 6-37. The basic operating principles are explained as follows.

With the Integral Charging System operating, a.c. voltages initially are generated in the stator windings by residual magnetism in the rotor. Current then flows through the diode trio, resistor R1, and resistor R4 to turn transistor TR1 on. The stator then supplies d.c.

BACK TO INDEX

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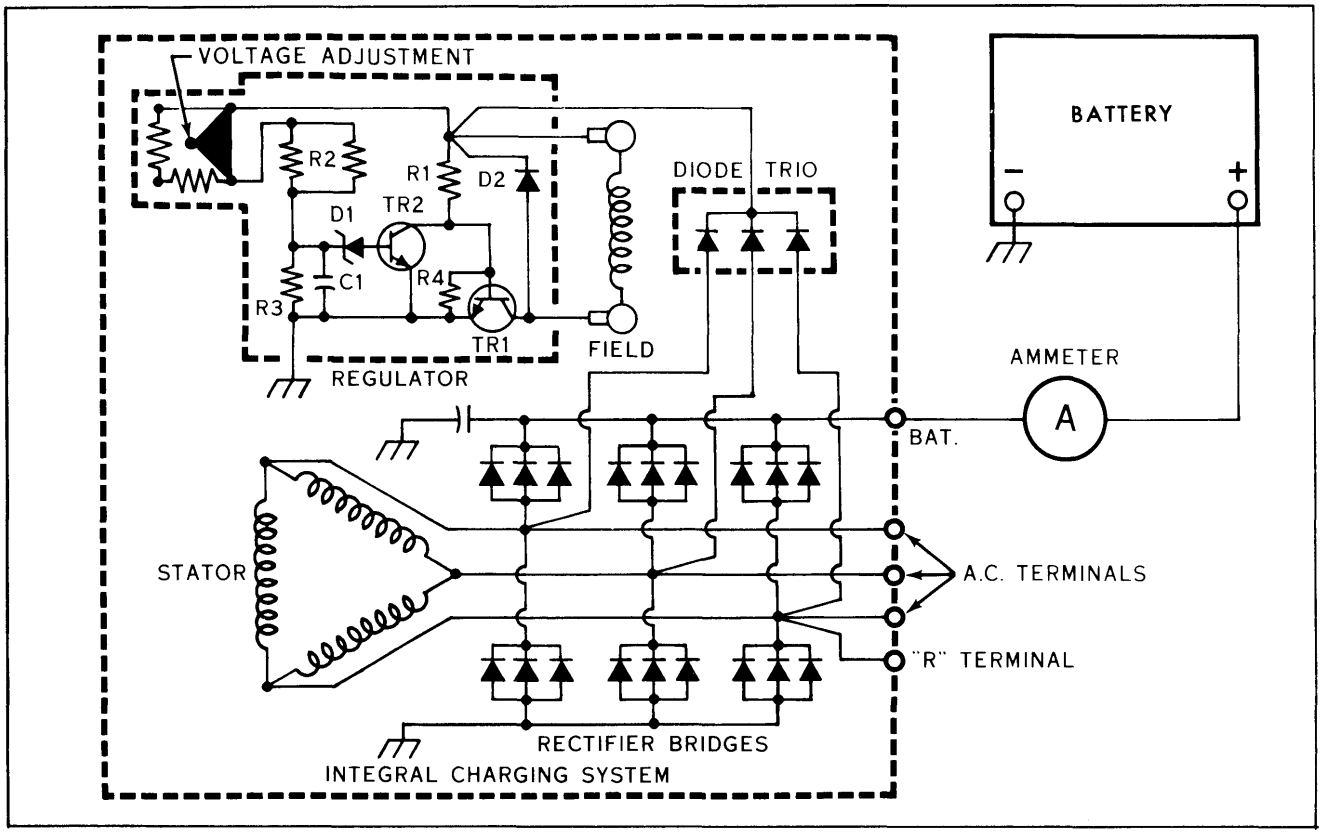


Fig. 6-37 Internal Wiring Diagram — Heavy Duty Generator

field current through the diode trio, the field, TR1, and then through the grounded diodes in the rectifier bridges back to the stator. Also, the diodes in the rectifier bridges change the stator a.c. voltages to a d.c. voltage which appears between ground and the "BAT" terminal. As speed increases, current is provided for charging the battery and operating electrical accessories.

As the speed and voltage increase, the voltage between R2 and R3 increases to the value where zener diode D1 conducts. Transistor TR2 then turns on and TR1 turns off. With TR1 off, the field current and system voltage decrease, and D1 then blocks current flow causing TR1 to turn back on. The field current and system voltage increase, and this cycle then repeats many times per second to limit the voltage to the adjusted value.

Capacitor C1 smooths out the voltage across R3, resistor R4 prevents excessive current through TR1 at high temperatures, and diode D2 prevents high-induced-voltages in the field windings when TR1 turns off.

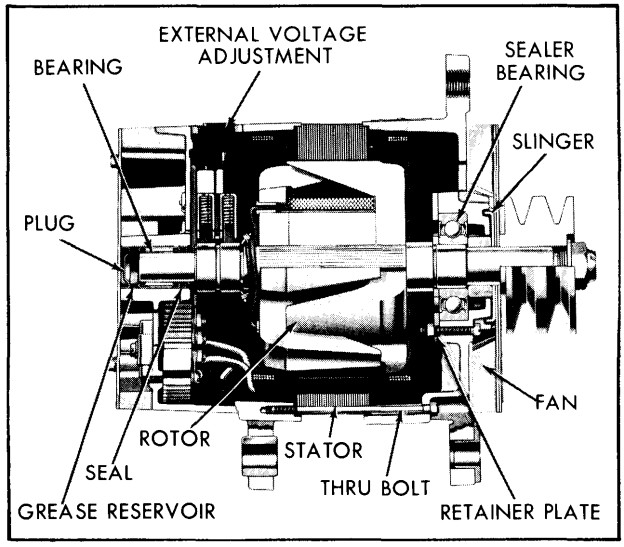


Fig. 6-38 Cutaway View of Heavy Duty Generator

DIAGNOSIS CHARGING SYSTEM

35. Analyzing Charging System Troubles

Close adherence to the following procedures in the order presented will lead to the location and correction of integral charging system defects in the shortest possible time. Only a portion of these procedures need be performed. It will seldom be necessary to perform all the procedures in order to locate the trouble.

A basic wiring diagram showing lead connections is shown in Fig. 6-39. To avoid damage to the electrical equipment, always observe the following precautions:

BACK TO INDEX

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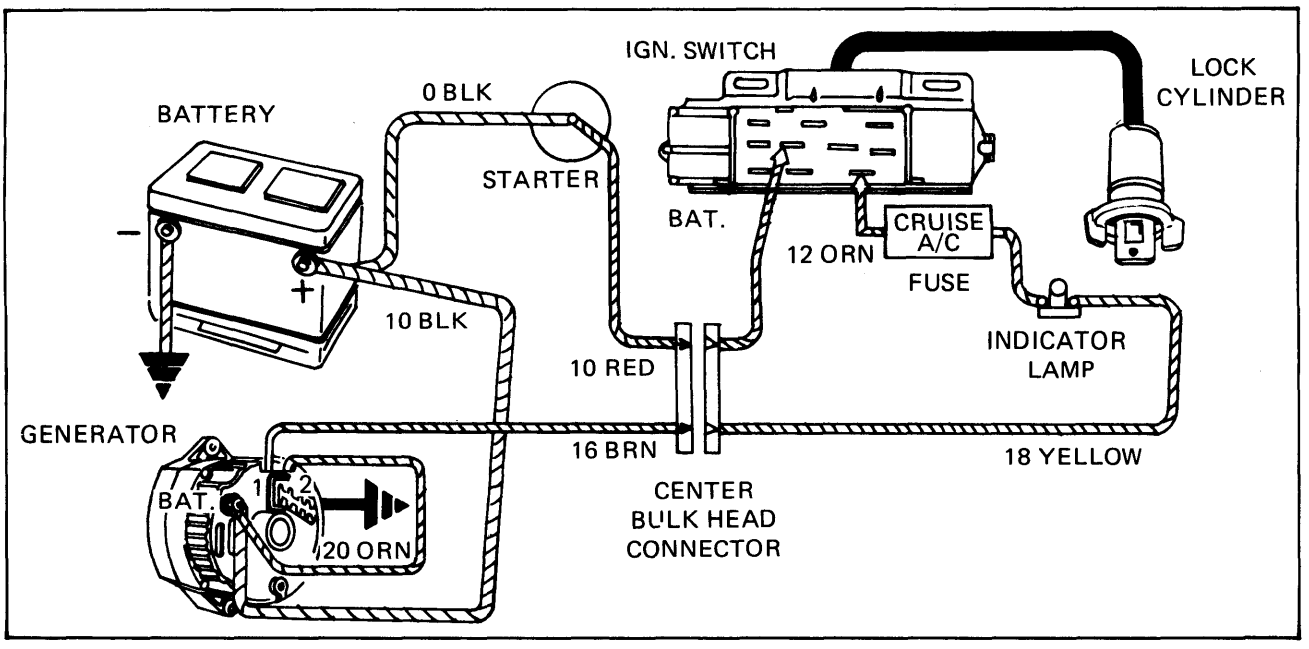


Fig. 6-39 Basic Charging Circuit

- Do not polarize the generator.
- Do not short across or ground any of the terminals in the charging circuit except as specifically instructed in this manual.
- NEVER operate the generator with the output terminal oper-circuited.
- Make sure the generator and battery have the same ground polarity.
- When connecting a charger or a booster battery to the vehicle, connect negative to negative and positive to positive.

Trouble in the charging system will show up as one or more of the following conditions:

A. Faulty indicator lamp operation.

B. An undercharged battery as evidenced by slow cranking.

C. An overcharged battery.

a. Faulty Indicator Lamp Operation

Check the indicator lamp for normal operation as follows:

Switch	Lamp	Engine
OFF	OFF	STOPPED
ON	ON	STOPPED
ON	OFF	RUNNING

If the indicator lamp operates normally, proceed to "Undercharged battery" or "Overcharged battery" section. Otherwise, proceed to either one of the following three abnormal conditions.

1. Switch Off, Lamp On—In this case, disconnect the two leads from the generator No. 1 and No. 2 terminals. If the lamp stays on, there is a short between these two leads. If the lamp goes out, replace the rectifier bridge as described in Note 11. This condition will cause an undercharged battery.

2. Switch On, Engine Running. Lamp Off—This condition can be caused by a blown (15 AMP) "Cruise A/C" fuse, a burned out light bulb, malfunctioning socket or an open in one of the following wires, (12 Orange) wire between the ignition switch and the Cruise A/C fuse; the (18 yellow) wire between the fuse and the light bulb or the (16 brn.) wire between the bulb and the bulk head connector.

3. Switch On, Engine Running, Lamp On—This condition is most likely caused by a broken fan belt. Check to make sure the No. 1 and No. 2 leads at the generator are correctly installed.

If the above conditions are OK, the problem is inside the generator. Disassemble and test the following components as described in Note 39; rectifier bridge, startor, field winding and diode trio. If no malfunction is found replace the regulator.

b. Undercharged Battery

The condition, as evidenced by slow cranking and low specific gravity readings, can be caused by one or more of the following conditions even though the indicator lamp may be operating normally.

1. Insure that the undercharged condition has not been caused by accessories having been left on for extended periods.
2. Check the drive belt for proper tension.

BACK TO INDEX
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3. If a battery malfunction is suspected, refer to battery diagnosis in Notes 11 through 14.

4. Inspect the wiring. Check all connections for tightness and cleanliness, including the slip connectors at the generator and firewall, and the battery cables and terminals and starter solenoid.

5. With all wiring harness leads connected, connect a voltmeter from:

a. generator "BAT" terminal to ground.
b. generator No. 1 terminal to ground.
c. generator No. 2 terminal to ground.

A zero reading indicates an open between voltmeter connection and battery. Some voltage should be indicated.

6. If previous Steps 1 through 5 check satisfactorily, check generator as follows:

7. Disconnect positive battery cable.

8. Install knife blade switch between battery positive terminal and battery cable.

(NOTE: Two battery terminal adapters are required to perform this operation on the side terminal battery. These adapters are available from several equipment manufacturers and their instructions for use should be followed.)

9. Connect VAT-20 as follows:

a. Set ground polarity switch to "negative" position.
b. Set load control to "direct" position.
c. Connect "BAT" lead of ammeter to knife blade switch terminal stud and connect "REG" lead to positive battery cable on the knife blade switch.
d. Connect ammeter "GRD" terminal to negative battery terminal.

10. Disconnect the feed wire from the heater or A/C blower motor.

11. Close knife blade switch and start engine.

12. Turn off all accessories and close car doors.

13. Open knife blade switch and raise engine speed to approximately 2000 RPM.

14. Adjust load control for highest ammeter reading. Voltage should not be allowed to rise above 16 volts.

15. If ampere output is within 10 percent of rated output as stamped on generator frame, generator most likely is not malfunctioning; recheck Steps 1 through5. Important: If output in amperes is O.K., but indicator lamp stays on, check diode trio and rectifier bridge in Note 39.

16. If ampere output is <u>not</u> within 10 percent of rated output, ground the field winding by inserting a screwdriver into the test hole, Fig. 6-40.

17. Operate engine at approximately 2000 RPM and adjust load control as required to obtain maximum current output.

18. If output is within 10 percent of rated output, replace regulator as described in Note 38.

19. If output is not within 10 percent of rated output, check the field winding, diode trio, rectifier bridge, and stator as described in Note 39.

20. Turn off engine and remove equipment from vehicle.

c. Overcharged Battery

If battery checks good, but an obvious overcharge condition exists proceed as follows:

1. Separate end frames as described in Note 38a.

Check Field winding for shorts. If shorted (0 reading) replace rotor and regulator.

2. Connect ohmmeter using lowest range scale from brush lead clip to end frame as shown in Step 1, Fig.

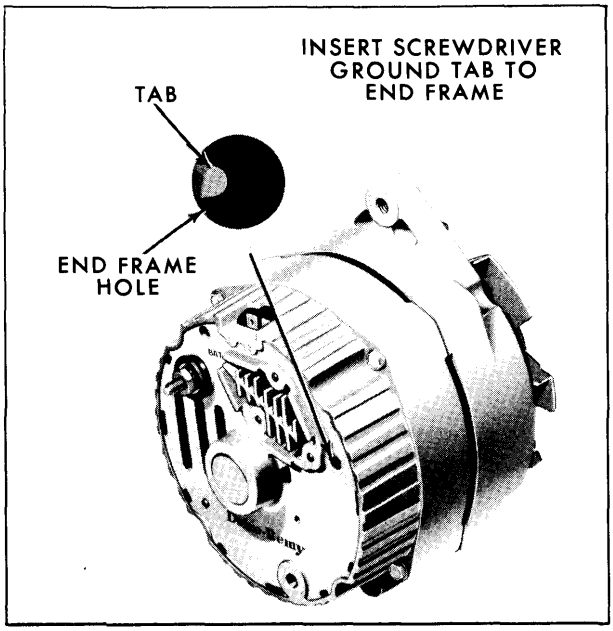


Fig. 6-40 Grounding Generator Field Winding

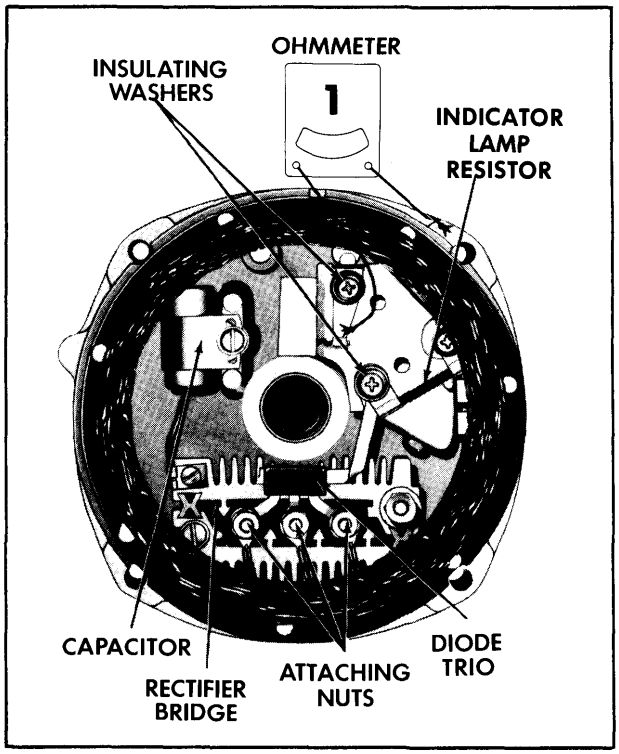


Fig. 6-41 Slip Ring End Frame Assembly

BACK TO INDEX

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6-41, then reverse lead connections.

3. If both readings are zero, either the brush lead clip is grounded or regulator is malfunctioning.

4. A grounded brush lead clip can result from omission of insulating washer, Fig. 6-46, omission of insulating sleeve over screw, or damaged insulating sleeve. Remove screw to inspect sleeve. If satisfactory, replace regulator as described in Note 38.

DIAGNOSIS
CHARGING SYSTEM (WITH H. D. GENERATOR)

36. Analyzing Charging System Trouble

Close adherence to the following procedures in the order presented will lead to the location and correction of charging system malfunctions in the shortest possible time. Only a portion of these procedures need be performed. It will seldom be necessary to perform all the procedures in order to locate the trouble.

A basic wiring diagram showing lead connections is shown in Fig. 6-42. To avoid damage to the electrical equipment always observe the following precautions:

- Do not polarize the Integral Charging System.
- Do not short across or ground any of the terminals in the charging circuit except as specifically instructed herein.
- Make sure the Integral Charging System and battery have the same ground polarity.

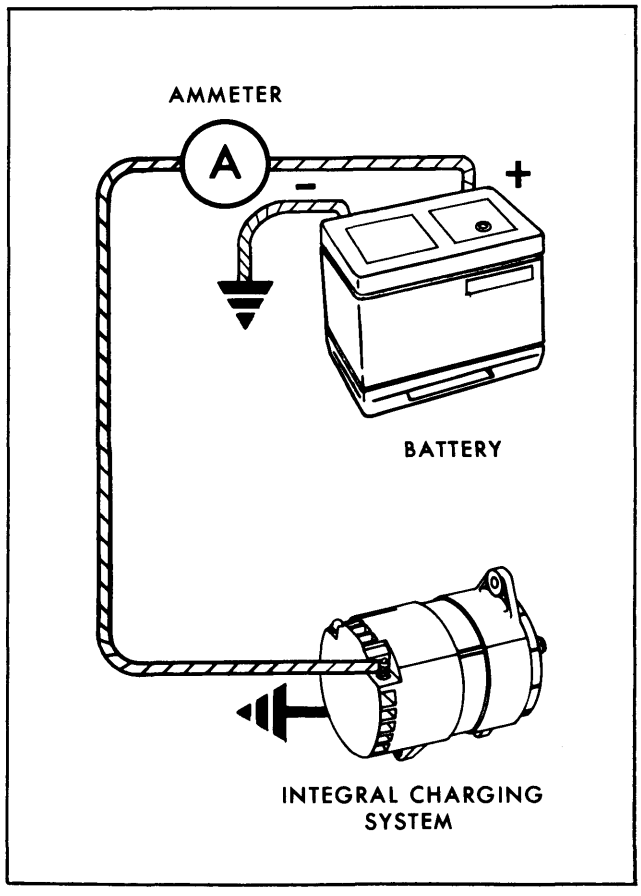


Fig. 6-42 Wiring Diagram — Heavy Duty Generator

- When connecting a charger or a booster battery to the vehicle battery, connect negative to negative and positive to positive.

Trouble in the charging system will show up as one or more of the following conditions:

a. Undercharged Battery

This condition, as evidenced by slow cranking and low specific gravity readings, can be caused by one or more of the following conditions:

1. Insure that the undercharged condition has not been caused by accessories having been left on for extended periods.
2. Check the drive belt for proper tension.
3. If a battery malfunction is suspected, proceed with checks.
4. Inspect the wiring. Check all connections for tightness and cleanliness, including the cable clamps and battery posts.
5. Connect a voltmeter from "BAT" terminal on Integral Charging System to ground. A zero reading indicates an open between voltmeter connection and battery.
6. If previous Steps 1 through 5 check satisfactorily, check Integral Charging System as follows:
7. Disconnect positive battery cable.
8. Install knife blade switch between battery positive post and battery cable terminal.
9. Connect VAT-20 tester as follows:

a. Set ground polarity switch to negative position.

b. Set load control to direct position.

Connect BAT lead of ammeter to knife blade switch terminal stud and connect REG lead to positive battery cable on the knife blade switch.

d. Connect ammeter GRD terminal to negative battery terminal.

10. On air conditioned cars, disconnect the 18T wire from the blower motor.
11. Close knife blade switch and start engine.
12. Turn off all accessories and close car doors.

CAUTION: The following specifications are critical and given values must be adhered to.

13. Open knife blade switch and raise engine speed to 750 rpm.

(NOTE: Voltage should not be allowed to rise above 16 volts.)

14. Adjust load control for highest ammeter reading.
15. Reading should be 95 amps. plus or minus 10 percent.

BACK TO INDEX

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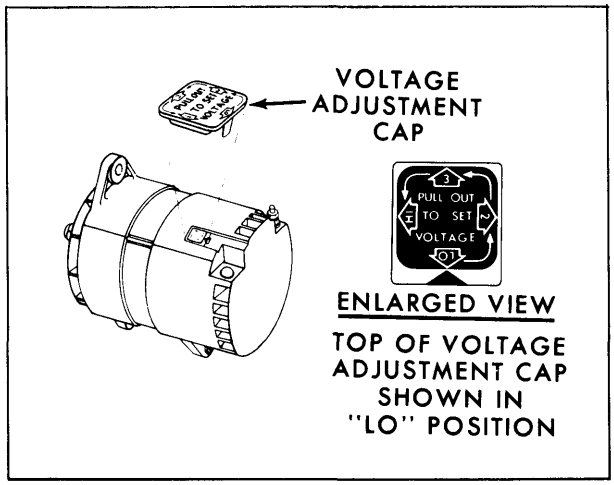


Fig. 6-43 Voltage Adjustment Cap

CAUTION: In no case should engine speed go above 750 rpm as generator is capable of producing 145 to 150 amps and will destroy ammeter.

16. If reading given in Step 15 is correct, generator is functioning normally. In this case, an adjustment of the voltage setting may correct the undercharged condition. Raise the setting by removing the voltage adjusting cap, rotating in increments of 90°, and then re-inserting the cap in the connector body. As illustrated in Fig. 6-43 the cap is set for low voltage. With position 2 aligned with the arrow, the setting is increased to medium low, position 3 is medium high, and position "HI" is the highest regulator setting. After adjusting the setting, check for an improved battery condition after a service period of reasonable length, such as one week.

(NOTE: The voltage adjustment in Fig. 6-43, is for purposes of illustration only. The actual adjustment as shipped from the factory may be in some other position such as position 3, depending on the application requirement.)

(NOTE: High underhood temperatures may cause amperage reading to be slightly lower than rated.)

17. If reading obtained is not correct, record amps for future reference and remove generator for repair as described in Note 40.

b. Overcharged Battery

1. Check the battery. Remember that an overheated battery will be overcharged even though no charging circuit defects are present.
2. If battery is not defective or overheated, connect a voltmeter between Integral Charging System "BAT" terminal and ground.
3. With all accessories turned off, increase engine speed as required to obtain maximum voltage reading.
4. If voltage exceeds 15 volts, remove Integral Charging System for repair as described in Note 40.
5. If voltage does not exceed the values listed in Step 4 preceding, adjust voltage to a lower value by removing voltage adjusting cap and re-inserting into connector body. Then check battery condition after a service period of reasonable length, such as one week. Fig. 6-43, is for purposes of illustration only, and shows the cap adjusted for the lowest setting. The actual adjustment as shipped from the factory may be in some other position, such as position 3, depending on the application requirement. The lowest setting is with "LO" aligned with the arrow, position 2 is medium low, position 3 is medium high, and "HI" is the highest setting.

SERVICE INFORMATION

37. Generator Removal and Installation (Except H.D. Generator) (Fig. 6-44)

a. Removal

1. Raise hood and disconnect negative battery cable.
2. Remove protective cap from generator battery terminal and remove wire from terminal.
3. Disconnect double connector from top of generator.
4. Remove screw from generator adjusting link.
5. Remove screw from rear of generator and retain shims for installation.
6. Loosen generator pivot bolt and remove generator drive belt.
7. Loosen A.I.R. pump pivot bolt behind pulley using a "starter wrench" (if so equipped).
8. Loosen two screws securing front bracket to engine.
9. Generator, spacer and lower through bolt may now be removed by twisting generator towards fender for bolt clearance.

b. Installation

1. Install lower through bolt and spacer on generator and swivel assembly into position. Start bolt threads into rear bracket.
2. Tighten two screws securing front bracket to engine, and one A.I.R. pump pivot bolt.
3. Loosely install adjustment link screw, install belt and tension generator belt as described in Note 10. Tighten generator pivot bolt.
4. Install enough shims at rear of generator to completely fill space between bracket and generator. Install screw and tighten to 20 foot-pounds.
5. Connect double connector at top of generator.
6. Connect wire to generator battery terminal and install protective cap.
7. Connect battery cable.

BACK TO INDEX

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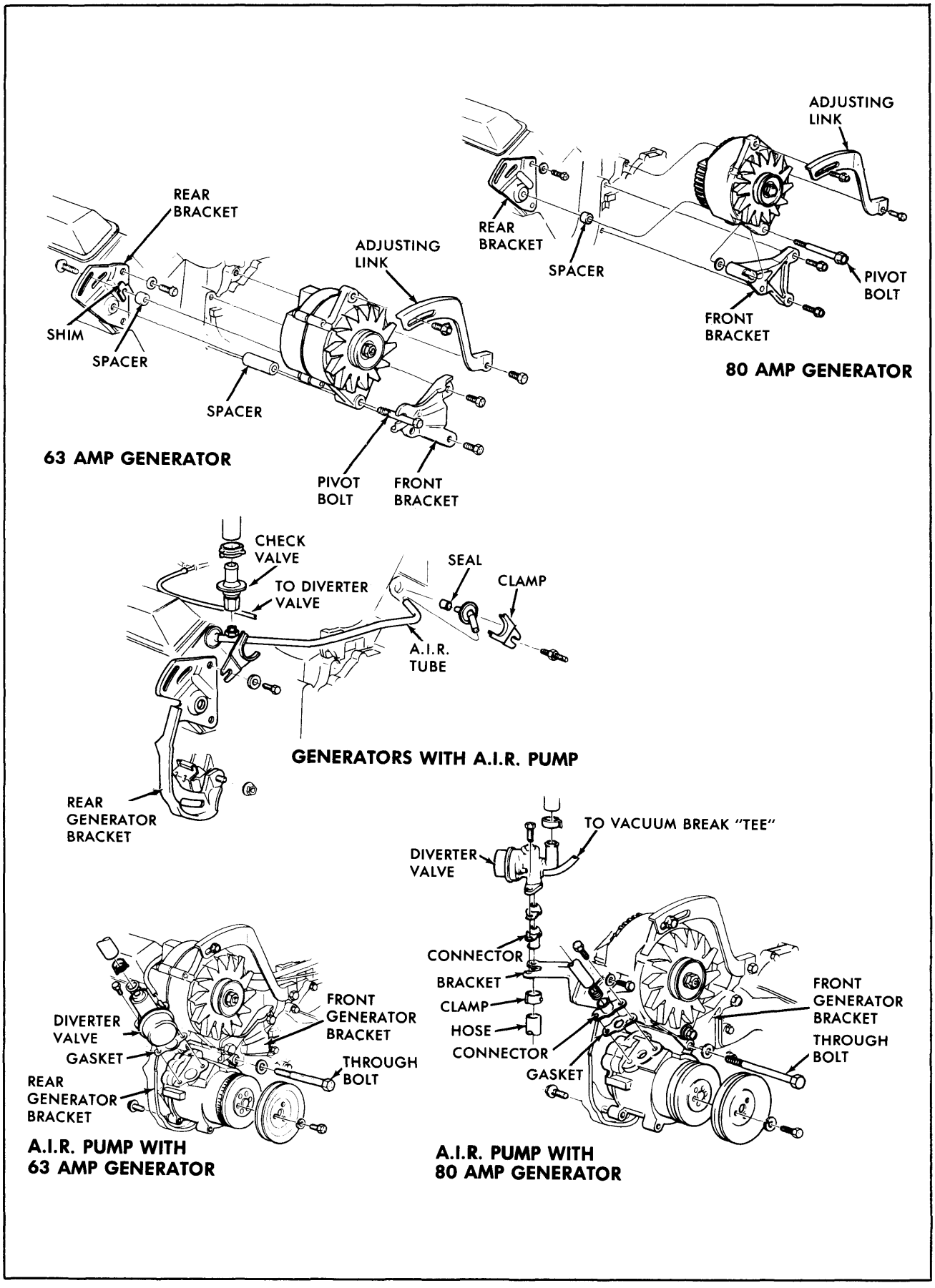


Fig. 6-44 Generator Attaching Parts

BACK TO INDEX

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38. Generator Disassembly and Assembly (Except H.D. Generator) (Fig. 6-45)

a. Disassembly

1. Scribe an alignment mark on both end frames to locate parts during assembly.
2. Remove four through bolts securing drive end frame to slip ring end frame.
3. Separate drive end frame and rotor from slip ring end frame and stator.

CAUTION: Brushes should be cleaned as soon as possible to prevent grease from soaking into brushes.

4. Remove brush springs which will now be loose.
5. Place a piece of tape (pressure sensitive tape, not friction tape) over the slip ring end bearing and the bearing shaft on the rotor.
6. Remove three nuts holding stator leads to rectifier bridge and remove stator.
7. Remove one screw with plastic insulator holding diode trio to brush holder and remove diode trio.
8. Remove screws securing regulator and brush holder. Remove indicator lamp resistor, brush holder and regulator.
9. Remove rectifier bridge by removing the following fasteners: one screw with washer; one screw at capacitor lead; one nut and washer from "BAT" terminal stud.
10. Remove insulator and "BAT" terminal stud.
11. Remove one screw securing capacitor to end frame and remove capacitor.
12. To remove rotor from drive end frame, install rotor in a vise and tighten only enough to permit removal of shaft nut.

CAUTION: Avoid excessive tightening as this may cause distortion of the rotor.

13. Remove shaft nut, washer, pulley and fan. Separate end frame from rotor.

b. Assembly

1. Position "BAT" terminal stud in end frame with molded plastic insulator outside and fiber insulator inside.
2. Position rectifier bridge to end frame and secure with nut and washer at one end and screw with washer at opposite end.
3. Install capacitor and secure to end frame and heat sink with screws, Fig. 6-46.
4. Position regulator in slip ring end frame. Position indicator lamp resistor and brush holder over regulator. Install two regulator mounting screws shown in Fig. 6-46.
5. Position diode trio on rectifier bridge and secure to regulator with insulated screw.
6. Position stator to end frame with leads over rectifier bridge studs and secure with three nuts.
7. Install brush springs and brushes in brush holder and insert a straight wire or pin through hole in end

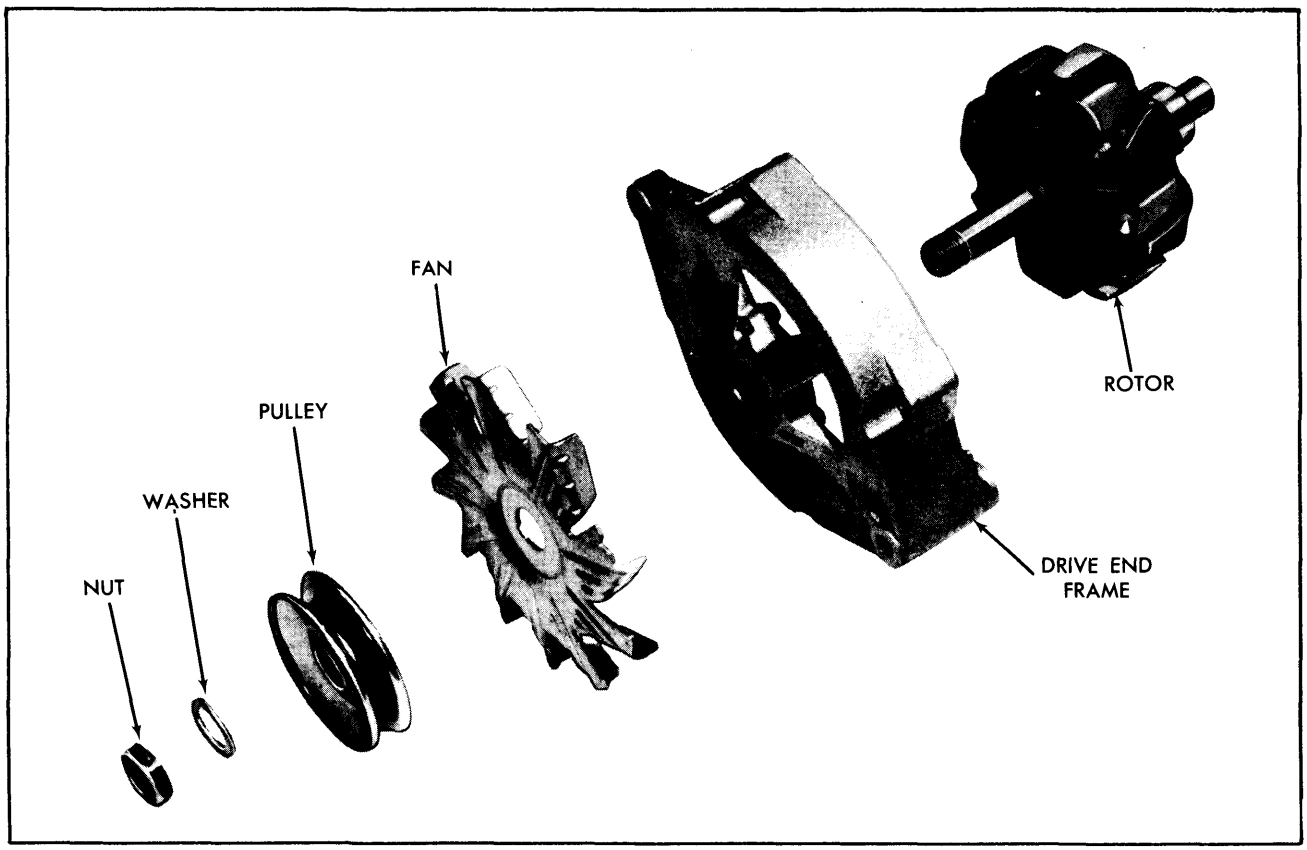


Fig. 6-45 Rotor and Drive End Frame

BACK TO INDEX

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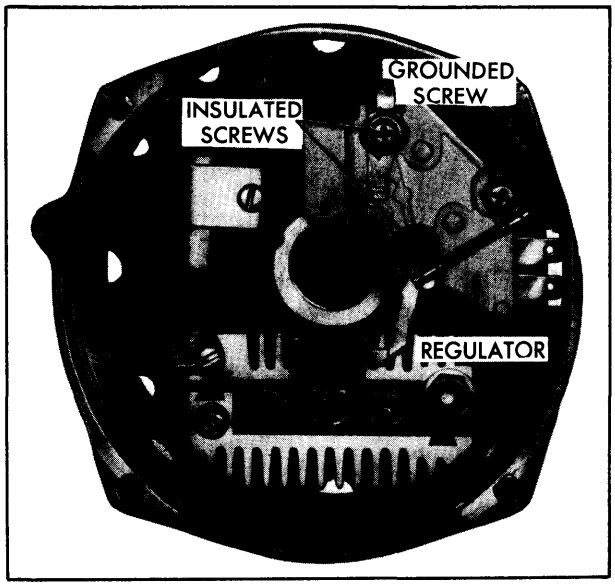


Fig. 6-46 Regulator Attaching Screw Location

frame and holes in bottom of brush holder. This will hold brushes until rotor is assembled into frame.

8. Install rotor in vise with drive end up. Tighten vise firm but not tight.

CAUTION: Avoid excessive tightening as this may cause distortion of the rotor.

9. Position end frame, fan, pulley and washer over rotor shaft, Fig. 6-45, secure with nut.

10. Install rotor to slip ring end frame aligning scribe marks when installing. Remove brush holding wire.

11. Secure drive end frame to slip ring end frame with four through bolts.

39. Generator Inspection and Test (Except H.D. Generator)

a. Rotor Field Winding Checks (Fig. 6-47)

To check for opens, connect the test lamp or ohmmeter to each slip ring. If the lamp fails to light, or if the ohmmeter reading is high (infinite), the winding is open.

The winding is checked for short circuits or excessive resistance by connecting a battery and ammeter in series with the edges of the two slip rings. The current flowing through the rotor winding should be 4.0 to 4.5 amperes at 80°F. A reading above 4.5 amperes indicates a short.

An alternate method is to check the resistance of the field by connecting an ohmmeter to the two slip rings. Ohmmeter should read 2.75 to 3.0 ohms. A reading below 2.75 ohms indicates a shorted rotor.

Remember that the winding resistance and ammeter readings will vary slightly with winding temperature changes. If the rotor is not malfunctioning, but the generator fails to supply rated output, the problem is in the diode trio, rectifier bridge or stator.

b. Diode Trio Check

To check the diode trio, remove it from the end

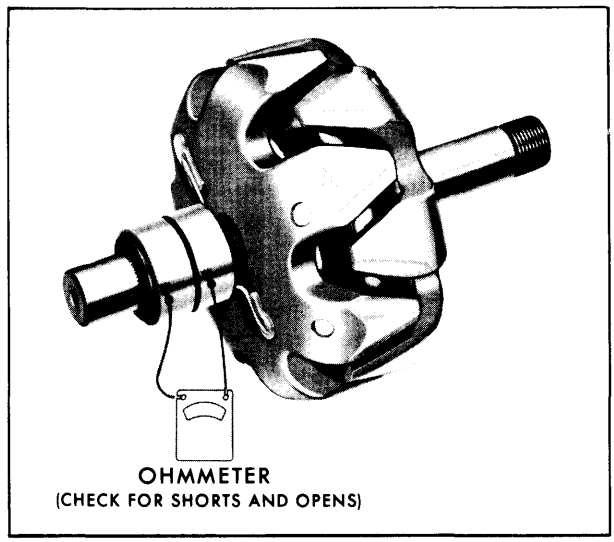


Fig. 6-47 Checking Rotor Windings

frame assembly by detaching the three nuts, the attaching screw, and removing the stator assembly. Note that the insulating washer on the screw is assembled over the top of the diode trio connector. Connect an ohmmeter having a 1-1/2 volt cell, and using the lowest range scale, to the single connector and to one of the three connectors, Fig. 6-48. Observe the reading. Then reverse the ohmmeter leads to the same two connectors. If both readings are the same, replace the diode trio. A good diode trio will give one high and one low reading. Repeat this same test between the single connector and each of the other two connectors. Also, connect the ohmmeter to each pair of the three connectors. If any reading is zero, replace the diode trio.

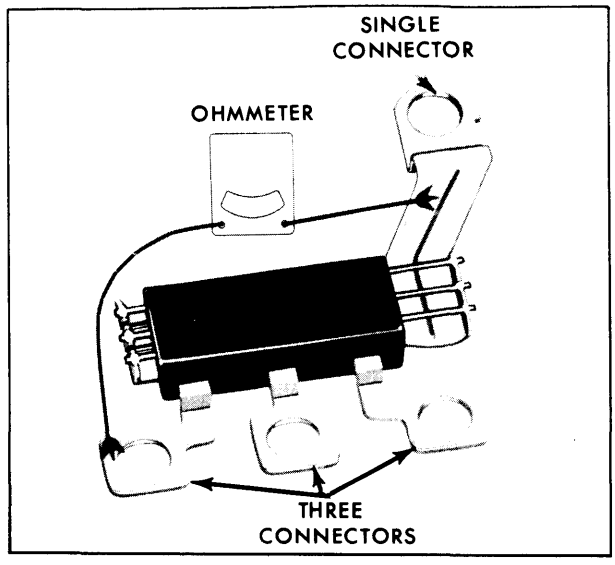


Fig. 6-48 Diode Trio Check

c. Rectifier Bridge Check

Note that the rectifier bridge has a grounded heat sink and an insulated heat sink connected to the output terminal. Also, note the insulating washer located between the insulated heat sink and end frame Fig. 6-49.

BACK TO INDEX

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To check the rectifier bridge, connect one lead of ohmmeter to the grounded heat sink and press down very firmly onto one of the flat metal connectors and not on threaded stud with other lead. Then reverse the lead connections to the grounded heat sink and press down very firmly onto the same flat metal connector, and not on threaded stud Fig. 6-49. If both readings are the same, replace the rectifier bridge. A good rectifier bridge will give one high and one low reading. Repeat this same test between the grounded heat sink and the other two flat metal connectors and between the insulated heat sink and each of the three metal connectors. This makes a total of six checks, with two readings taken for each check.

The ohmmeter check of the rectifier bridge, and of the diode trio as previously covered, is a valid and accurate check. Do not replace either unit unless at least one pair of readings is the same.

CAUTION: Do not use high voltage to check these units. Use only ohmmeter or 12 volt test lamp.

To replace the rectifier bridge, remove the attaching screw and the "BAT" terminal screw, and disconnect the capacitor lead. Note the insulator between the insulated heat sink and end frame Fig. 6-49.

d. Stator Checks (Fig. 6-50)

The stator windings may be checked with a 110-volt test lamp or an ohmmeter. If the lamp lights, or if the meter reading is low when connected from any stator lead to the frame, the windings are grounded. If the lamp fails to light, or if the meter reading is high when successively connected between each pair of stator leads, the windings are open.

To test stator windings for shorts, check the readings of each of the three winding phases, using and ohmmeter

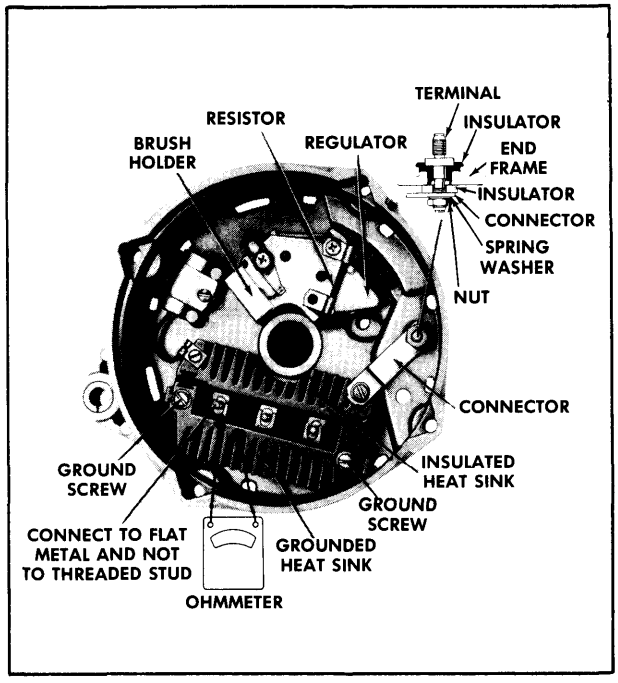


Fig. 6-49 Checking Rectifier Bridge

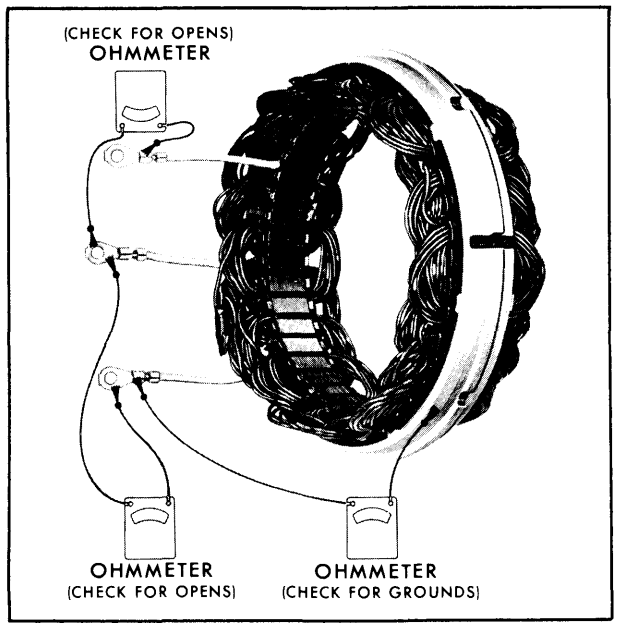


Fig. 6-50 Checking Stator Windings

"Hook-up" as shown in Fig. 6-51. Ohmmeter used should indicate readings in tenths (.1) of an ohm. Ohmmeter readings for these phases should be equal. If not a short exists and stator must be replaced.

(NOTE: A black or dark brown appearance of the stator windings is normal and should not, by itself, be reason for replacement until the stator windings are checked with an ohmmeter as explained above.)

e. Brush Holder and Regulator Replacement

After removing the three attaching nuts, the stator, and diode trio screw Fig. 6-49 the brush holder and regulator may be replaced by removing the two remaining screws. Note the two insulators located over the top of the brush clips in Fig. 6-46, and that these two screws have special insulating sleeves over the screw body above the threads. The third mounting screw may

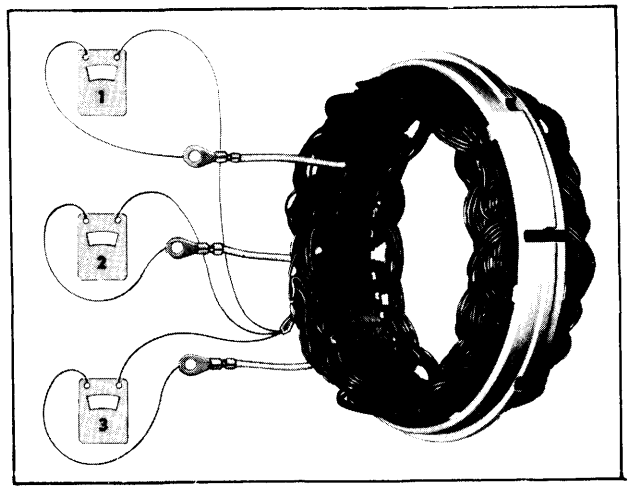


Fig. 6-51 Checking Stator Windings For Shorts

BACK TO INDEX

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or may not have an insulating sleeve. If not, this screw must not be interchanged with either one of the other two scews, as a ground may result, causing no output or uncontrolled generator output. Regulators may vary in appearance but are completely interchangeable in these generators.

f. Slip Ring Servicing

If the slip rings are dirty, they may be cleaned and finished with 400 grain or finer polishing cloth. Spin the rotor, and hold the polishing cloth against the slip rings until they are clean.

CAUTION: The rotor must be rotated so that the slip rings will be cleaned evenly. Cleaning the slip rings by hand without spinning the rotor may result in flat spots on the slip rings, causing brush noise.

Slip rings which are rough or out of round should be trued in a lathe to .002 inch maximum indicator reading. Remove only enough material to make the rings smooth and round. Finish with 400 grain or finer polishing cloth and blow away all dust.

g. Bearing Replacement and Lubrication

The bearing in the drive end frame can be removed by detaching the retainer plate screws, and then pressing the bearing from the end frame. If the bearing is in satisfactory condition, it may be reused, and it should be filled one-quarter full with lubricant No. 1948791 or equivalent before reassembly.

CAUTION: Do not overfill, as this may cause the bearing to overheat.

To install a new bearing, press in with a tube or collar that just fits over the outer race, with the bearing and slinger assembled into the end frame as shown in Fig. 6-52. It is recommended that a new retainer plate be installed if the felt seal in the retainer plate is hardened or excessively worn. Fill the cavity between the retainer plate and bearing with 1948791 lubricant or equivalent.

The bearing in the slip ring end frame should be replaced if its grease supply is exhausted. No attempt should be made to re-lubricate and reuse the bearing. To remove the bearing from the slip ring end frame, press out with a tube or collar that just fits inside the end frame housing. Press from the outside of the housing towards the inside.

To install a new bearing, place a flat plate over the bearing and press in from the outside towards the inside of the frame until the bearing is flush with the outside of the end frame. Support the inside of the frame with a hollow cylinder to prevent breakage of the end frame. Use extreme care to avoid misalignment or otherwise placing undue stress on the bearing.

It is recommended that a new seal be installed whenever the bearing is replaced. Press the seal in with the lip of the seal toward the rotor when assembled, that is, away from the bearing. Lightly coat the seal lip with oil to facilitate assembly of the shaft into the bearing.

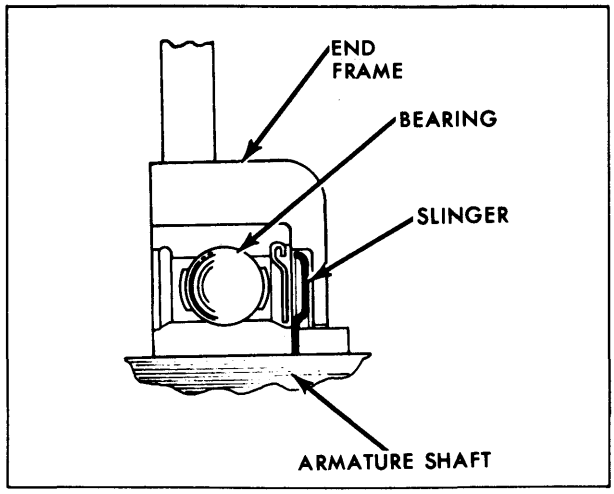


Fig. 6-52 Drive End Bearing Assembly

40. Generator Removal and Installation (With H.D. Generator) Fig. 6-53

a. Removal

1. Disconnect negative battery cable from battery and position out of way.
2. Disconnect all wiring connections from generator and position out of way.
3. Loosen belt tensioning pulley bolts to relieve belt tension and remove belt.
4. Remove two nuts and lock washers from lower mounting bolts, at generator, leaving bolts in place.
5. Remove bolt and lock washer from upper mounting at generator and remove generator by sliding rearward off lower mounting bolts.

b. Installation

1. Position generator to lower mounting bracket and install lower mounting bolts.
2. Install bolt and lock washer securing generator to upper mounting bracket and tighten bolt to 60 ft. lbs.
3. Install lock washers and nuts on lower mounting bolts and tighten nuts to 60 ft. lbs.
4. Position belt around generator and belt tensioning pulley and adjust belt tenison as described in Note 10b. Tighten tensioning pulley bolts to 19 foot-pounds.
5. Position wiring harness and connect to required generator terminals.
6. Position negative battery cable and connect to battery.
7. Polarize charging system by momentarily connecting a jumper wire between the generator "BAT" terminal and the generator "R" terminal.
8. Start engine and operate at 1500 RPM for 10 seconds. Generator lamp should go out.

BACK TO INDEX

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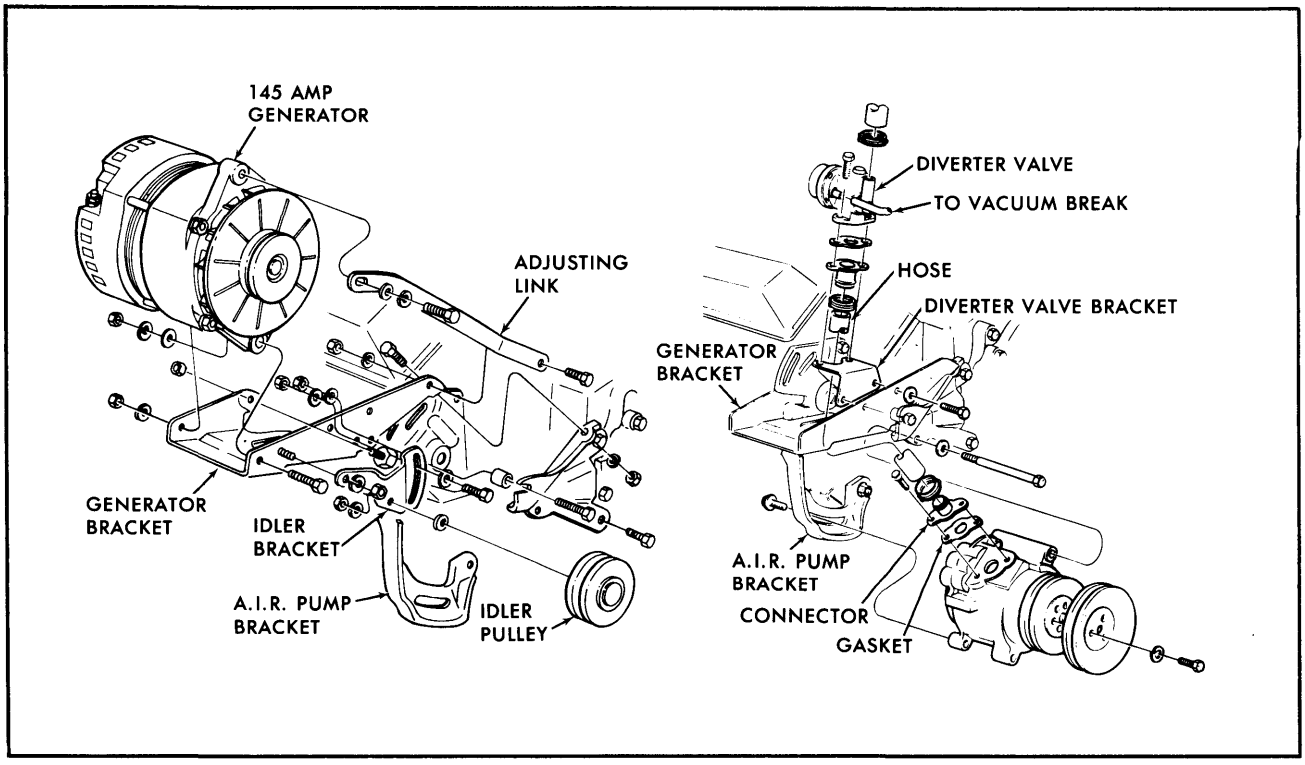


Fig. 6-53 Generator Mounting – H.D. Generator

41. Generator Disassembly and Assembly (With H.D. Generator)

a. Disassembly

1. Remove cover plate from slip ring end frame.
2. Hold rotor shaft with allen wrench while removing shaft nut. Remove washer, pulley, fan and slinger.
3. Remove four through bolts securing drive end frame to slip ring end frame and separate slip ring end frame and stator from drive end frame and rotor.

CAUTION: Brushes should be cleaned as soon as possible to prevent grease from soaking into brushes.

4. Separate stator from slip ring end frame by removing the nuts and washers from the three stator lead studs, Fig. 6-54.
5. Place tape over bearing and shaft to protect from dirt. Use pressure sensitive tape and not friction tape which would leave a gummy deposit.
6. Remove two remaining nuts and washers from each rectifier bridge.
7. Remove the following from the A.C. terminal studs: nut, lockwasher, flat washer insulating washer and insulating collar.
8. Remove screw with flat washer and insulator securing diode trio at brush holder and remove diode trio, A.C. leads and inner insulator.
9. Remove connector strap from each rectifier bridge.
10. Remove two nuts with internal tooth lock-washers and flat washers securing bottom rectifier bridge and remove two terminal studs.
11. Remove one screw with lock and flat washers

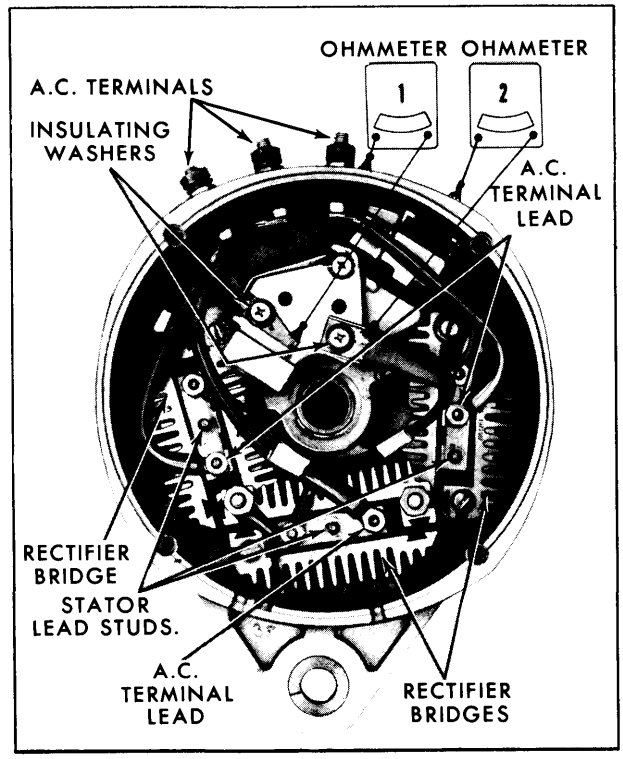


Fig. 6-54 Slip Ring End Frame (With Heavy Duty Generator)

BACK TO INDEX

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securing bottom rectifier bridge to end frame and remove rectifier bridge.

12. To remove bridge nearest voltage adjuster, remove two screws with lock and flat washers.

13. To remove remaining rectifier bridge it is necessary to loosen the nut at the "BAT" terminal. Remove one screw with external tooth lockwasher securing "BAT" terminal lead to bridge.

14. Remove one additional screw securing bridge to end frame and remove bridge.

15. Remove two remaining screws securing brush holder and remove brush holder.

16. Remove voltage adjuster cap making note of cap position for assembly.

17. Remove one screw securing voltage regulator bracket to end frame and remove bracket and regulator.

18. Capacitor and "R" terminal lead may now be removed if desired.

19. To remove rotor from drive end frame, remove four screws from around drive end bearing and tap rotor out of housing with a soft faced hammer.

20. To remove bearings refer to Note 42i.

b. Assembly (Fig. 6-55)

1. Install capacitor and "R" terminal lead if removed.

2. Position voltage regulator and adjuster to end frame. Position bracket over adjuster and secure with one screw and external tooth lockwasher.

3. Install voltage adjustment cap in same position as removed.

4. Of the three rectifier bridges, two are identical and one has an insulating sleeve at one end. Select one of the two identical ones and position under the "BAT" lead. Secure to end frame using one screw with lock and flat washers. Secure "BAT" lead to bridge using one screw with external tooth lockwasher.

5. Tighten "BAT" terminal nut.

6. Install bridge with insulator at opposite side of end frame. Secure using two screws with lock and flat washers.

7. Position remaining rectifier bridge in end frame. Install two terminal bolts with internal tooth lockwashers. Use a flat washer at end with insulated bridge and capacitor lead at opposite end. Install but do not tighten nuts.

8. Install one screw with lock and flat washers securing bridge to end frame and tighten screw. Tighten two nuts installed in Step 7.

9. Install connector strap to each bridge.

10. Install insulator at inside of end frame for A.C. terminal studs and position diode trio and A.C. terminal leads.

11. Install insulating sleeve, insulating washer, flat washer, lockwasher and nut to each A.C. terminal. Tighten nuts.

12. Position diode trio and A.C. leads at each bridge. Secure each lead with nut and flat washer.

13. Install brush holder over voltage regulator and secure with three screws. Two screws nearest bearing have insulating washers. All screws have flat washers.

14. Install brush springs and brushes. Hold brushes. Hold brushes in position with paper clip through holder and end frame.

15. Position stator to end frame with notches in stator aligned with holes for through bolts.

16. Install stator leads to bridges at remaining open terminals. Secure with nuts and flat washers.

17. If removed, install drive end frame to rotor. Align weld nut plate and secure with four screws.

18. Remove tape from slip ring end bearing and rotor shaft. Make sure the shaft is perfectly clean after removing the tape.

19. Install rotor and drive end frame to stator and slip ring end frame after aligning mounting lugs and through bolt holes. Secure with four through bolts.

20. Remove brush holding pin and install cover plate to slip ring end frame. Secure with four screws.

21. Assemble slinger, fan, pulley, washer and nut on rotor shaft. Hold rotor shaft with an allen wrench and tighten nut to 75 foot-pounds.

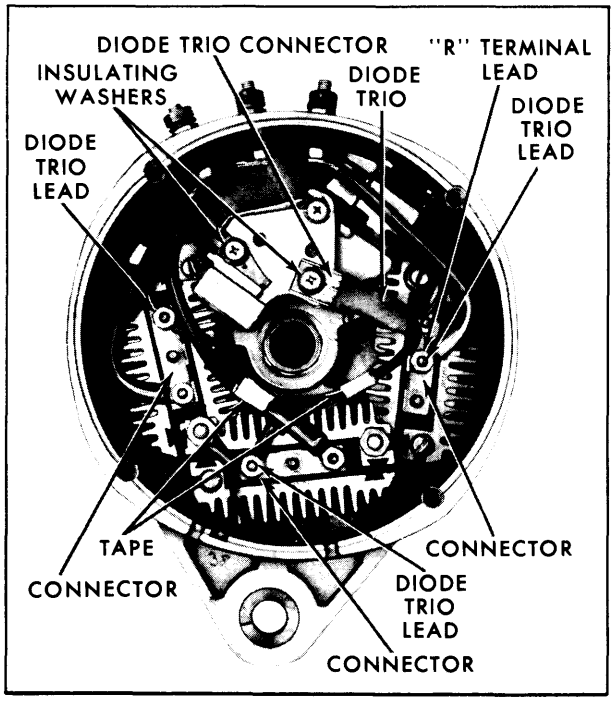


Fig. 6-55 Slip Ring End Frame Components (With Heavy Duty Generator)

42. Generator Inspection and Test (With H.D. Generator)

a. Ohmmeter Checks

1. Connect ohmmeter number 1 (having a 1-1/2 volt cell and using lowest range scale) from brush lead clip to end frame as shown in Fig. 6-54. Then reverse lead connections.

2. If both readings are zero, either the brush lead clip is grounded or regulator is malfunctioning.

3. A grounded brush lead clip can result from

BACK TO INDEX

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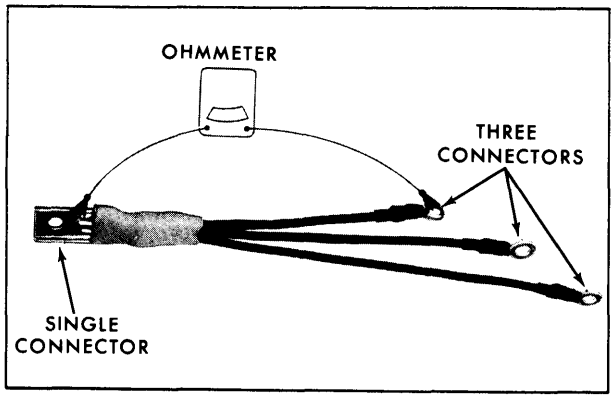


Fig. 6-56 Checking Diode Trio (With Heavy Duty Generator)

omission of insulating washer, Fig. 6-54, omission of insulating sleeve over screw, or damaged insulating sleeve. Remove screw to inspect sleeve. If satisfactory, replace regulator as described in Part g of this Note.

4. Repeat Steps 1, 2 and 3 above, except connect number 2 ohmmeter as shown Fig. 6-54.

b. Diode Trio Check

The diode trio is identified in Fig. 6-55. To check the diode trio, remove it from the end frame assembly by detaching the nuts and attaching screw. Note that the insulating washer on the screw is assembled over the top of the diode trio connector. Connect an ohmmeter having a 1-1/2 volt cell, and using the lowest range scale, to the single connector and to one of the three connectors in Fig. 6-56. Observe the reading. Then reverse the ohmmeter leads to the same two connectors. If both readings are the same, replace the diode trio. A good diode trio will give one high and one low reading. Repeat this same test between the single connector and each of the other two connectors.

(NOTE: Diode trios differing in appearance may be specified for use in the same integral Charging System, and the two are completely interchangeable.)

c. Rectifier Bridge Check

Note that each rectifier bridge has a grounded heat sink and an insulated heat sink. The insulated heat sinks are connected together, and electrically are connected to the output or "BAT" terminal. Also, note the stack-up of parts in Fig. 6-57.

To check the rectifier bridge, connect one lead of ohmmeter to a heat sink and press down very firmly onto one of the flat metal connectors and not on threaded stud with other lead. Then reverse the lead connections to the same heat sink and press down very firmly onto the same flat metal connector, and not on threaded stud Fig. 6-57. If both readings are the same, replace the rectifier bridge. A good rectifier bridge will give one high and one low reading. Repeat this same test between the grounded heat sink and the other two flat metal connectors and not on the threaded studs. This makes a total of six checks, with two readings taken for each check. Check the other two rectifier bridges in the same manner.

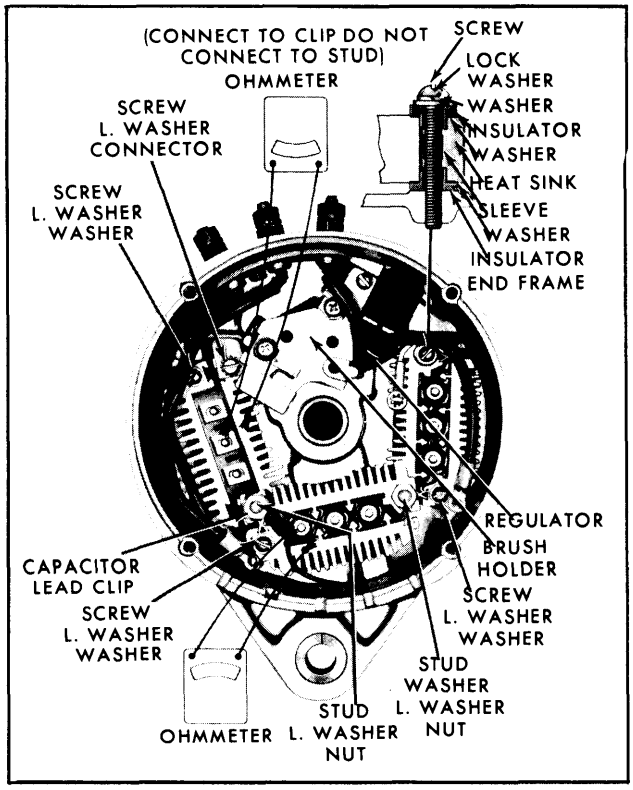


Fig. 6-57 Slip Ring End Frame Parts Position (With Heavy Duty Generator)

The ohmmeter check of the rectifier bridge, and of the diode trio as previously covered, is a valid and accurate check. Do not replace either unit unless at least one pair of readings is the same.

CAUTION: Do not use high voltage to check these units. Use only ohmmeter or 12 volt test lamp.

d. Rotor Field Winding Checks (Fig. 6-58)

To check for opens, connect the test lamp or ohmmeter to each slip ring. If the lamp fails to light, or if the ohmmeter reading is high (infinite), the winding is open.

The winding is checked for short circuits or excessive

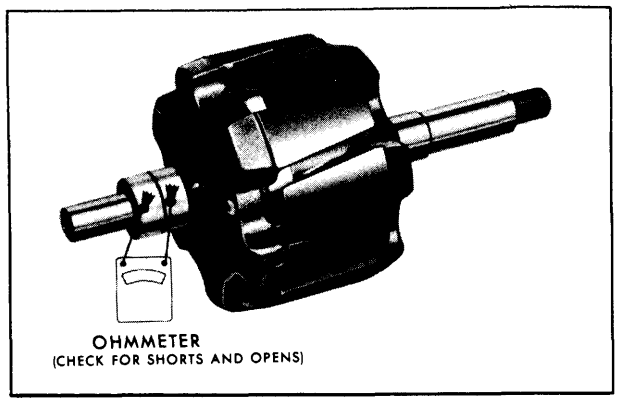


Fig. 6-58 Checking Rotor (With Heavy Duty Generator)

BACK TO INDEX

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resistance by connecting a battery and ammeter in series with the edges of the two slip rings. The current flowing through the rotor winding should be 4.0 to 4.5 amperes at 80°F. A reading above 4.5 amperes indicates a short.

If the winding is shorted, replace the rotor, and the regulator as described in part g of this note.

(NOTE: Regulator replacement may have been indicated in Part a of this note.)

An alternate method is to check the resistance of the field by connecting an ahmmeter to the two slip rings. Ohmmeter should read 2.75 to 3.0 ohms. A reading below 2.75 ohms indicates a shorted rotor.

Remember that the winding resistance and ammeter reading will vary slightly with winding temperature changes.

e. Stator Checks (Fig. 6-59)

The stator windings may be checked for grounds with a 110-volt test lamp or an ohmmeter. If the lamp lights, or if the meter reading is low when connected from any stator lead to a clean metal part of the frame, the windings are grounded. The delta windings cannot be checked for opens or for short circuits without laboratory test equipment. However, if all other electrical checks are normal and the generator fails to supply rated output, but will supply at least 10 amperes output, shorted stator windings are indicated.

f. Regulator Check (Fig. 6-60)

Since the regulator is completely enclosed, there is no practical way to check this unit with a test instrument. If none of the previous checks show any defects, and an overcharged condition was present, remove the connector body from the regulator and check with an ohmmeter using the middle range scale. Connect the ohmmeter to each adjacent pair of terminals, making four checks in all. If any one check is infinite, replace the connector body. The connector body need not be checked for an undercharged condition.

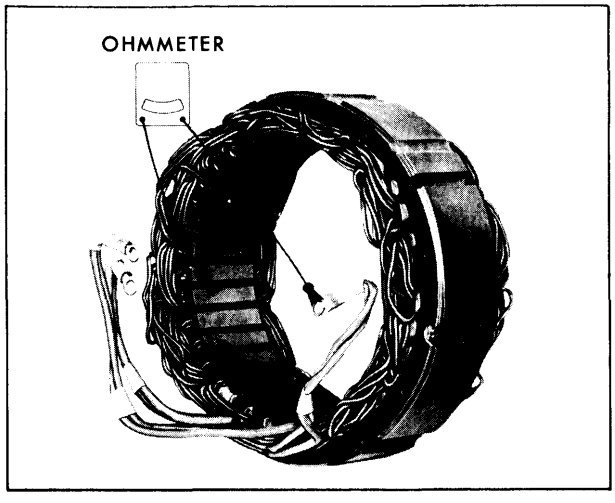


Fig. 6-59 Checking Stator (With Heavy Duty Generator)

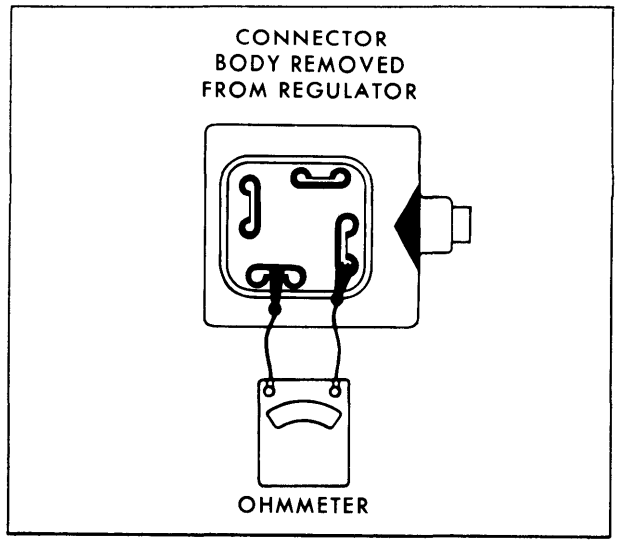


Fig. 6-60 Checking Connector Body (With Heavy Duty Generator)

If all of the previous checks are satisfactory, replace the regulator provided that in the previous performance checks:

1. The maximum ampere output was less than 10 amperes, or
2. The system voltage was over 15 volts.

g. Brush Holder and Regulator Replacement

After removing the stator and diode trio, the brush holder and regulator may be replaced by removing the two remaining screws. Note the two insulators located over the top of the brush clips in Fig. 6-55, and that these two screws have special insulating sleeves over the screw body above the threads. The third mounting screw may or may not have an insulating sleeve. If not this screw must not be interchanged with either one of the other two screws, as a ground may result, causing no output or uncontrolled output.

h. Slip Ring Servicing

If the slip rings are dirty, they may be cleaned and finished with 400 grain or finer polishing cloth. Spin the rotor, and hold the polishing cloth against the slip rings until they are clean.

CAUTION: The rotor must be rotated in order that the slip rings will be cleaned evenly.

Cleaning the slip rings by hand without spinning the rotor may result in flat spots on the slip rings, causing brush noise.

Slip rings which are rough or out of round should be trued in a lathe to .002 inch maximum indicator reading. Remove only enough material to make the rings smooth and round. Finish with 400 grain or finer polishing cloth and blow away all dust.

BACK TO INDEX

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i. Bearing Replacement and Lubrication

The drive end frame bearing is sealed on both sides, and cannot be lubricated. To replace the bearing, pull off of rotor shaft using Puller J-8433. Use a tube or collar that just fits over the inner race to press the new bearing into the end frame.

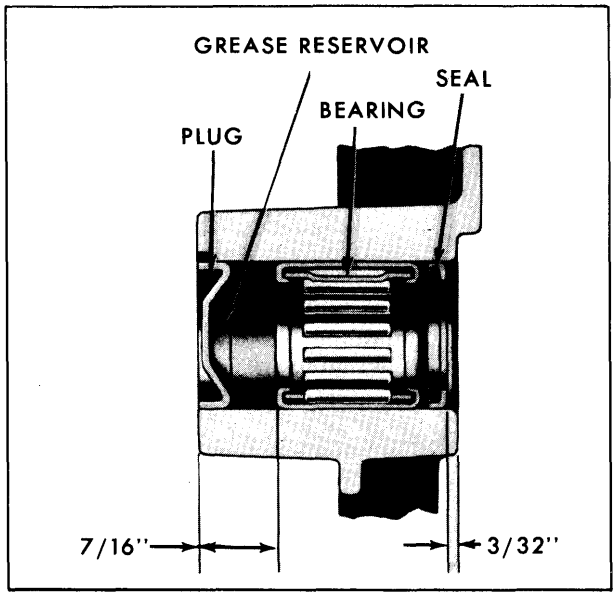


Fig. 6-61 Slip Ring End Bearing Assembly (With Heavy Duty Generator)

The bearing in the slip ring end frame should be replaced if its grease supply is exhausted. No attempt should be made to relubricate and reuse the bearing. To remove the bearing from the slip ring end frame, press out with a tube or collar that just fits inside the end frame housing.

To install a new bearing, use the tube or collar to press the bearing in from the outside of the housing towards the inside to the dimension shown in Fig. 6-61. Fill the plug with No. 1948791 lubricant or equivalent so that when pressed in flush with the end frame the grease reservoir will be half filled. Insure that some of the lubricant will be contacting the bearing when the plug is assembled. Use a new seal, and press in to the dimension shown in Fig. 6-61. Coat the seal lip with the lubricant to facilitate assembly of the rotor shaft into the bearing. Note that the lip of the seal is toward the bearing.

j. Magnetizing the Rotor

The rotor normally retains magnetism to provide voltage build-up when the engine is started. After disassembly or servicing, however, it may be necessary to reestablish the magnetism. To magnetize the rotor connect the Integral Charging System to the battery in a normal manner, then momentarily connect a jumper lead from the battery positive post to the Integral Charging System relay terminal, identified in Fig. 6-36. This procedure will restore the normal residual magnetism in the rotor.

BACK TO INDEX

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SPECIFICATIONS

BATTERY

Replace with	R89W
Capacity	60 AMP Hours
Voltage	12 Volts
Cables	1/0 Gage
Terminal Grounded	Negative
Cranking Power at 0°F.	3500 Watts

STARTER MOTOR

Brush Springs Tension	35 OZ
No Load Specifications	
Voltage	9 Volts
Amperage	65-95 AMPS
Speed	7,000-10,500 RPM

SOLENOID

Amperage Draw at 10 Volts	
Hold-In Winding	14.5-16.5 AMPS
Both Windings	41-47 AMPS

GENERATOR

Rated Output (At 14 Volts):	
All Except Limousine and Commercial Chassis	63 AMPS
Limousine and Commercial Chassis*	80 AMPS
Commercial Chassis with H.D. Generator	145 AMPS
Field Current Draw (At 12 Volts and 80°F)	4.0 to 4.5 AMPS

GENERATOR PULLEY RATIO:

63 AMP Without A.I.R.	3.09 to 1
63 AMP With A.I.R.	3.36 to 1
80 AMP Without A.I.R.	2.86 to 1
80 AMP With A.I.R.	3.12 to 1
145 AMP	2.28 to 1

DISTRIBUTOR

Initial Timing Except EFI	6° BTDC
EFI	12°BTDC
Rotation	Clockwise
Firing Order	1,5,6,3,4,2,7,8
Centrifugal Advance	See Page 6-8
Vacuum Advance	See Page 6-8

IGNITION COIL

Primary Resistance	.4 to .5 OHMS
Secondary Resistance	8000-9500

SPARK PLUGS

Type (AC Number)	R-45NSX
Gap	.060 In.
Thread Diameter	14 MM
Torque	25 Foot-Pounds

*Also includes with Trailer Towing Package and K97 option.

BACK TO INDEX

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TORQUE SPECIFICATIONS

Material No.	Application	Size	Torque
260M	Battery Cable to Battery Screw	3/8–16	70 In. Lbs.
260M	Battery Hold Down Screw	5/16–24	6 Ft. Lbs.
260M	Battery Ground Strap to Frame Screw	Self Tapping	22 Ft. Lbs.
286M	Distributor Clamp Nut	5/16–24	18 Ft. Lbs.
260M	Generator Adjusting Link to Generator Screw	5/16–18	10 Ft. Lbs.
300	Generator Support Bracket Screw	3/8–16	17 Ft. Lbs.
280	Generator Support Bracket Nut	3/8–24	17 Ft. Lbs.
286M	Generator Terminal Nuts	1/4–20	26 In. Lbs.
	Spark Plugs	14 mm	25 Ft. Lbs.
280M	Starter Motor Mounting Screw Exc. Eld.	3/8–16	46 Ft. Lbs.
280M	Starter Motor Mounting Screw Eldorado	7/16–14	46 Ft. Lbs.
Special	Starter Motor Brace to Mounting Screw	5/16–18	12 Ft. Lbs.
Special	Starter Motor Brace Mounting Nut	1/4–20	6Ft. Lbs.

NOTE: Refer to back of manual, page 16-1 for bolt and nut markings and steel classification.

SPECIAL TOOLS

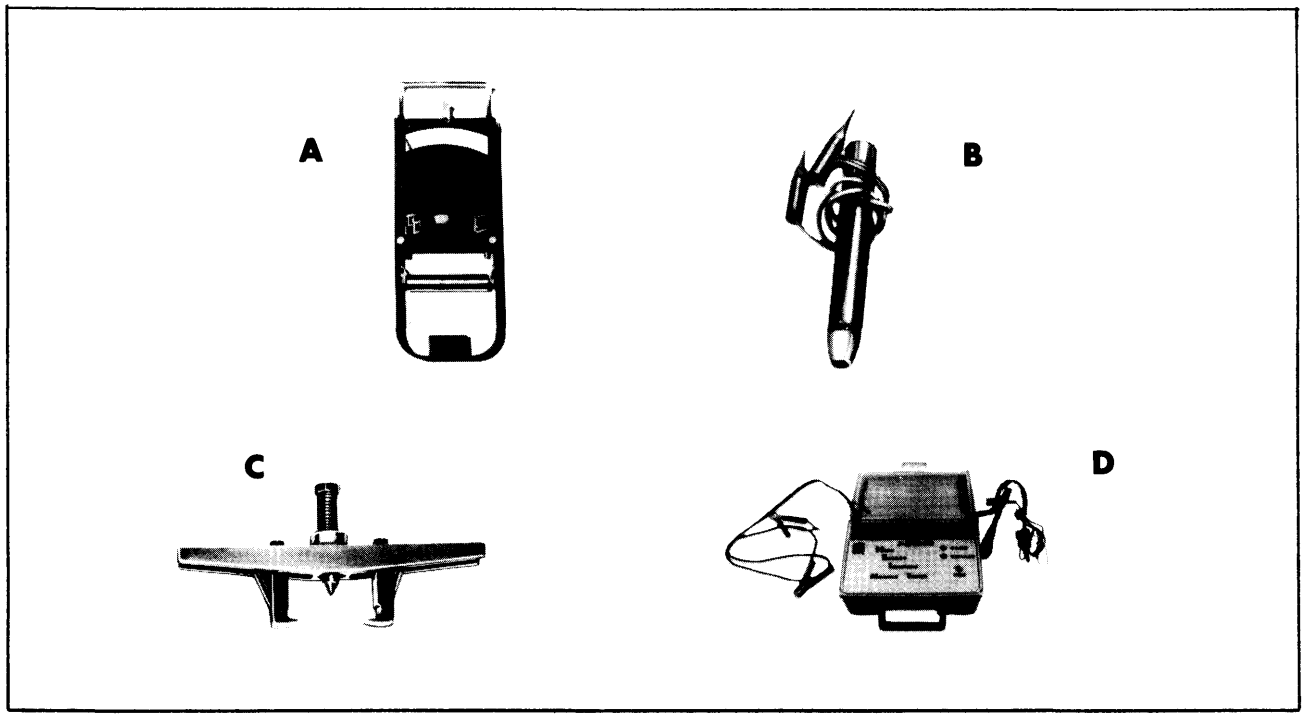


Fig. 6-62 Special Tools

Key	Tool No.	Name
A	J-23600	Belt Tension Gage
B	J-21008	Diode Tester
C	J-8433	Puller
D	J-24642	HEI Tester

BACK TO INDEX

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1976 CARBURETOR DESIGN CHANGES

M4ME — M4MEA QUADRAJET CARBURETOR

The Rochester models M4ME-M4MEA Quadrajet carburetors (Fig. 6-63) for 1976 Cadillacs are similar in operation to the 1975 Quadrajet models except for the following:

1. All carburetors are recalibrated to meet requirements of the 1976 engine.

2. The barometric pressure-sensitive aneroid has been removed from all Federal and California carburetors (models M4ME) with the exception of an altitude option carburetor (model M4MEA).

3. A fuel inlet check valve is used with the fuel filter to meet Motor Vehicle Safety Standards (M.V.S.S.) for roll-over. (See operation, Float System)

4. The bowl vent valve, released on 1975 models, is removed.

5. The main metering system is changed on M4ME models in that separate main wells feed each fuel nozzle for improved fuel flow in the venturi system.

6. On M4ME Models, an adjustable part throttle screw is added in the float bowl to calibrate fuel mixtures for good emission control. On the altitude option M4MEA carburetor, an adjustable aneroid and metering rod assembly is used to control part throttle air/fuel ratios.

7. The power system is changed in that a single (primary) power piston, with metering rods, is used on all models.

8. A new fast idle cam, with revised steps, is used on all models for improved cold driveaway performance.

The M4ME-M4MEA model Quadrajet carburetors are two stage carburetors of downdraft design. The revised carburetors include the proven design features of previous models. The triple venturi system (with 1-7/32" venturi) is used on the primary side of the Quadrajet carburetor, with small 1-3/8" throttle bores. The triple venturi plus small primary throttle bores, results in good fuel control during part throttle operation.

The secondary side has two large bores (2-1/4"). Using the air valve principle in the secondary side, fuel is metered in direct proportion to the air passing through the secondaries.

The carburetor part number is stamped on a vertical section of the float bowl, near the secondary throttle lever. Refer to the part number on the bowl when servicing the carburetor. When replacing the float bowl assembly, follow the manufacturer's instructions contained in the service package.

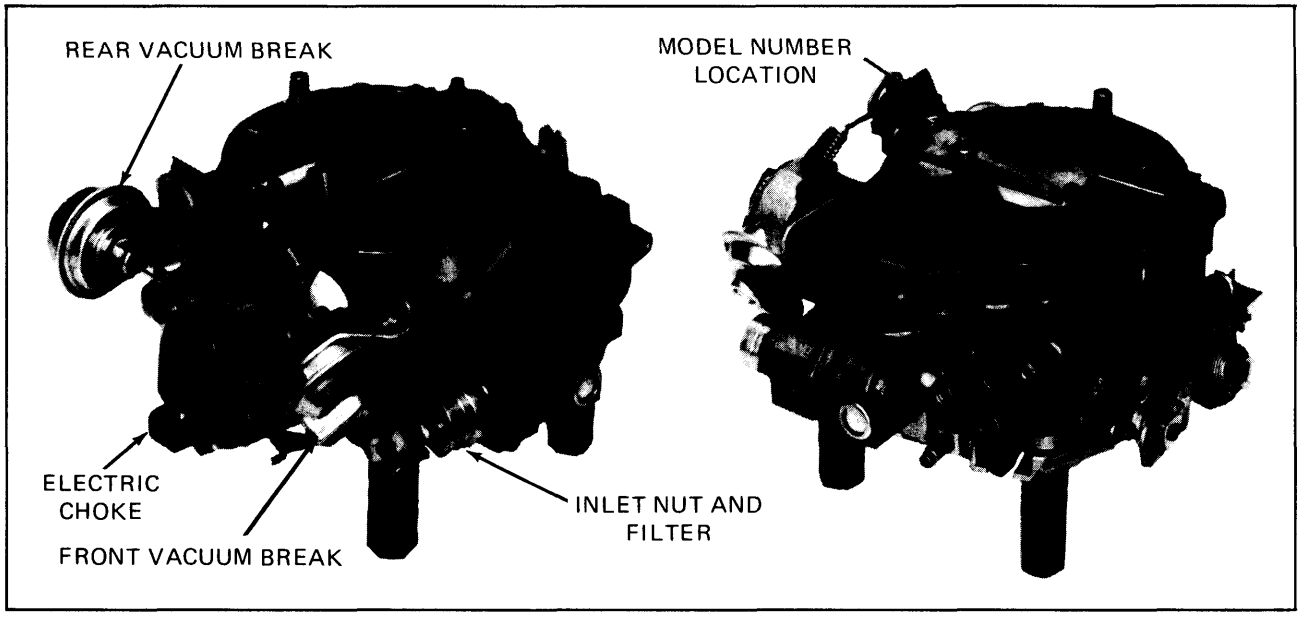


Fig. 6-63 Quadrajet M4ME and M4MEA Carburetors

GENERAL DESCRIPTION

The engine fuel system, Fig. 6-64, covered in this section includes fuel pump, fuel line to carburetor, carburetor, fuel filter, intake manifold and related components of these assemblies.

(NOTE: Electronic fuel injection section is found on page 6-86. Refer to EFI Section for all EFI and related items.)

BACK TO INDEX

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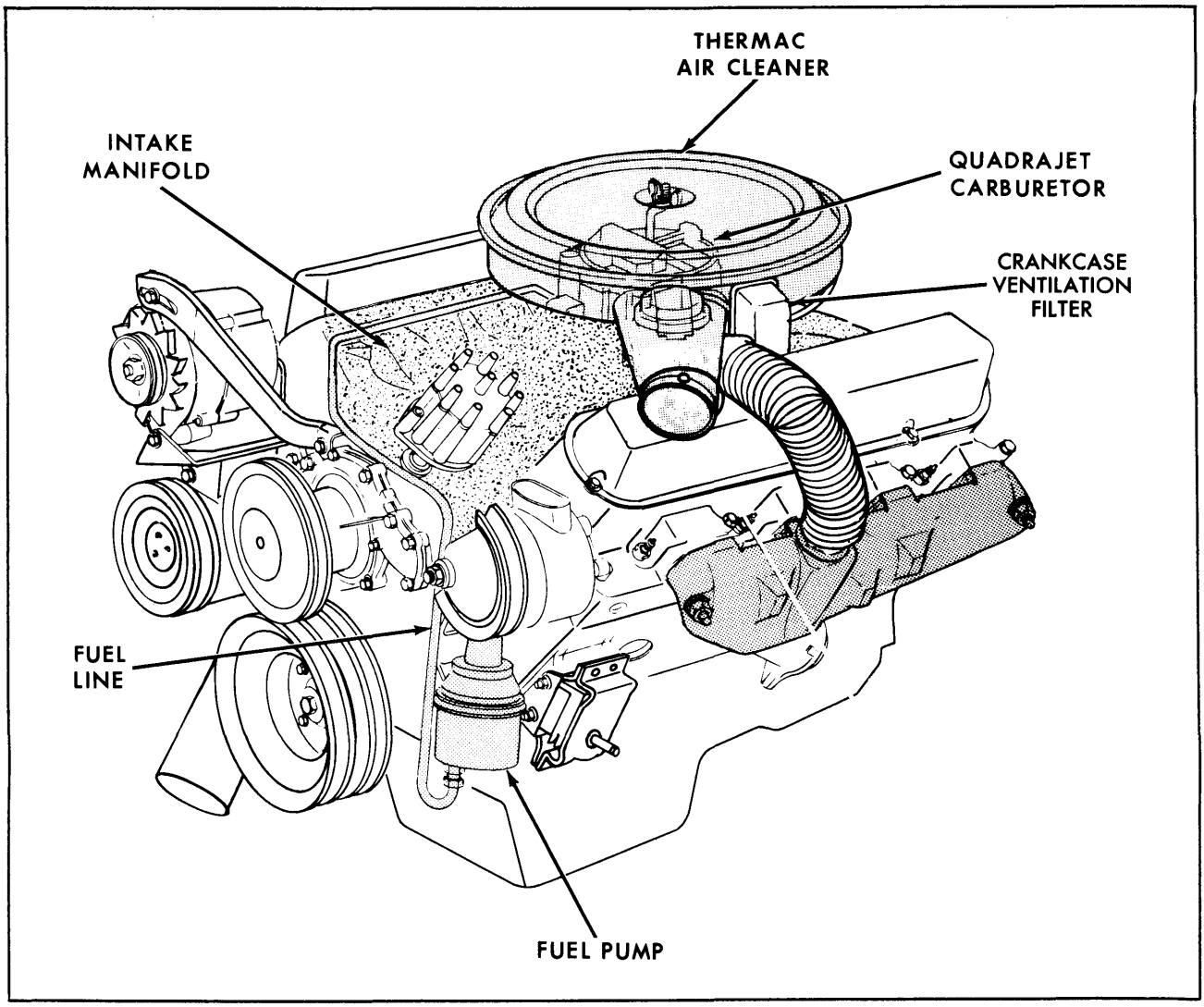


Fig. 6-64 Fuel System Components

Storage Precautions

When a car is to be put in storage for 30 days or longer, it is best to drain all gasoline from the fuel system, including carburetor, fuel filter, fuel pump, lines and tank. This assures freedom from gum deposits that would be formed by evaporation of the fuel. See Section 0, Page 0-10 for further precautions.

Fuel Pump

The fuel pump, Fig. 6-64, is mounted on the left front of the engine and incorporates a large fuel reservoir. The pump rocker arm is driven by an eccentric bolted to the camshaft. Fuel is drawn into the fuel pump on the upward stroke of the diaphragm as the rocker arm is moved downward by the cam eccentric working against the force of the spring. The diaphragm is forced downward by the spring during the delivery stroke of the pump, and exerts pressure on the fuel equal to the spring load as the eccentric travels to minimum stroke. This design provides a smooth, even flow of fuel to the carburetor.

Most engine operating conditions do not require a full travel of the diaphragm in the fuel pump. Whenever this condition occurs, an overriding spring keeps the rocker arm in contact with the cam eccentric at all times while the diaphragm displaces fuel equal to engine demand.

The fuel pump is a sealed unit and is serviced only as an assembly.

All cars use a fuel pump with a bypass passage that continually returns part of the fuel to the fuel tank. This bypass also returns fuel vapors that may form in the lines or pump under high operating temperatures.

Fuel Filter

The fuel filter, Fig. 6-65, is mounted behind the carburetor inlet nut. It filters out dirt particles in excess of approximately .002 inch in diameter. Should the fuel

BACK TO INDEX

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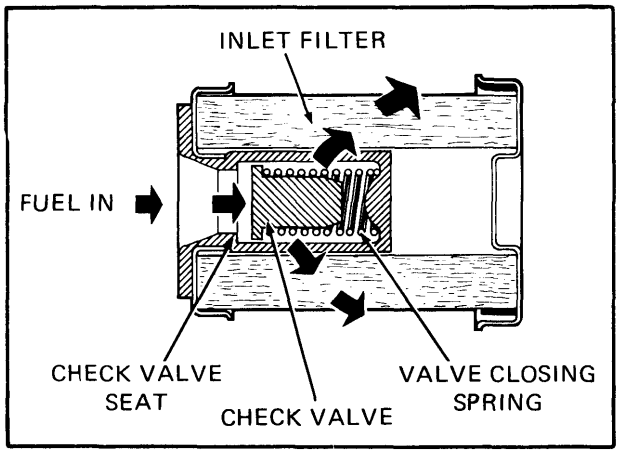


Fig. 6-65 Fuel Filter and Check Valve

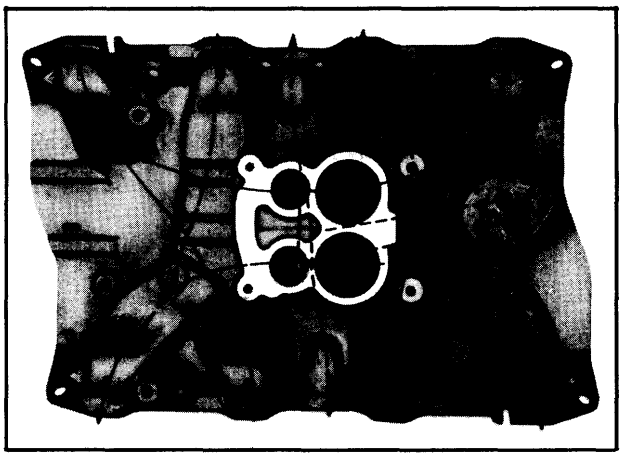


Fig. 6-66 Intake Manifold Passages

filter become clogged with dirt, fuel flow will stop since there is no bypass passage.

The fuel filter should be replaced each 15,000 miles or 12 months, preferably in the spring.

Carburetor Air Cleaner

All engines use a carburetor air cleaner incorporating a replaceable paper filter element, to remove dirt from the air before it enters the carburetor, Fig. 6-64. The addition of a cold air inlet duct provides cooler air to the air cleaner, for increased engine performance at all altitudes.

CAUTION: Do not operate the engine without the air cleaner unless temporary removal is necessary during repair or maintenance of the vehicle. When the air cleaner is removed, backfiring can cause fire in the engine compartment.

Intake Manifold

The intake manifold is designed to provide passages that are short and nearly equal in length. Each pair of bores, one primary and one secondary, feeds fuel to four cylinders two on each bank as shown in Fig. 6-66.

The intake manifold has two additional passages for circulating exhaust gas to the induction system by way of an exhaust gas recirculating (EGR) valve mounted at the rear of the manifold. These passages and EGR valve are part of the oxides of nitrogen (NO_X) emission control system.

One passage connects the exhaust gas crossover passage with the round hole at the rear of the manifold. The second passage connects the rectangular hole at the rear of the manifold (next to round hole) with the 3/8" diameter drilled holes in the floor under each primary bore.

The intake manifold is heated by exhaust gases passing through a crossover passage cast into the center of the manifold under the carburetor bores. Preheating the fuel-air mixture in this manner contributes to uniform fuel distribution and more complete vaporization.

15. Fuel Requirements

Cadillac engines are designed to operate on UNLEADED fuel only. A restricted fuel tank filler neck is used to deter addition of leaded fuels as described in Section 8, Page 8-1. Unleaded fuel will minimize spark plug fouling as well as prevent contamination of the catalytic converter. A complete description of the exhaust system including the catalytic converter is presented in Section 8.

(NOTE: Cadillacs built for operation in foreign countries where unleaded fuel may not be available, can be equipped with option K-72 which deletes the restricted gas tank filler neck and the catalytic converter.)

Transmission Downshift Switch

All cars utilize a rotary transmission downshift switch that is activated at 60° throttle opening by the throttle adapter plate. This switch controls the detent downshift of the transmission through an electrical circuit that energizes the transmission detent solenoid.

The switch is located at the left of the carburetor and secured by two screws to a support attached to the intake manifold. Adjustment of the switch is covered in Section 7, Note 4c.

THEORY OF OPERATION

QUADRAJET CARBURETOR

The four-barrel Quadrajet carburetor, Fig. 6-67, has two stages of operation. The primary (fuel inlet) side has small bores with a triple venturi equipped with plain tube nozzles. Its metering principles are similar to those

BACK TO INDEX

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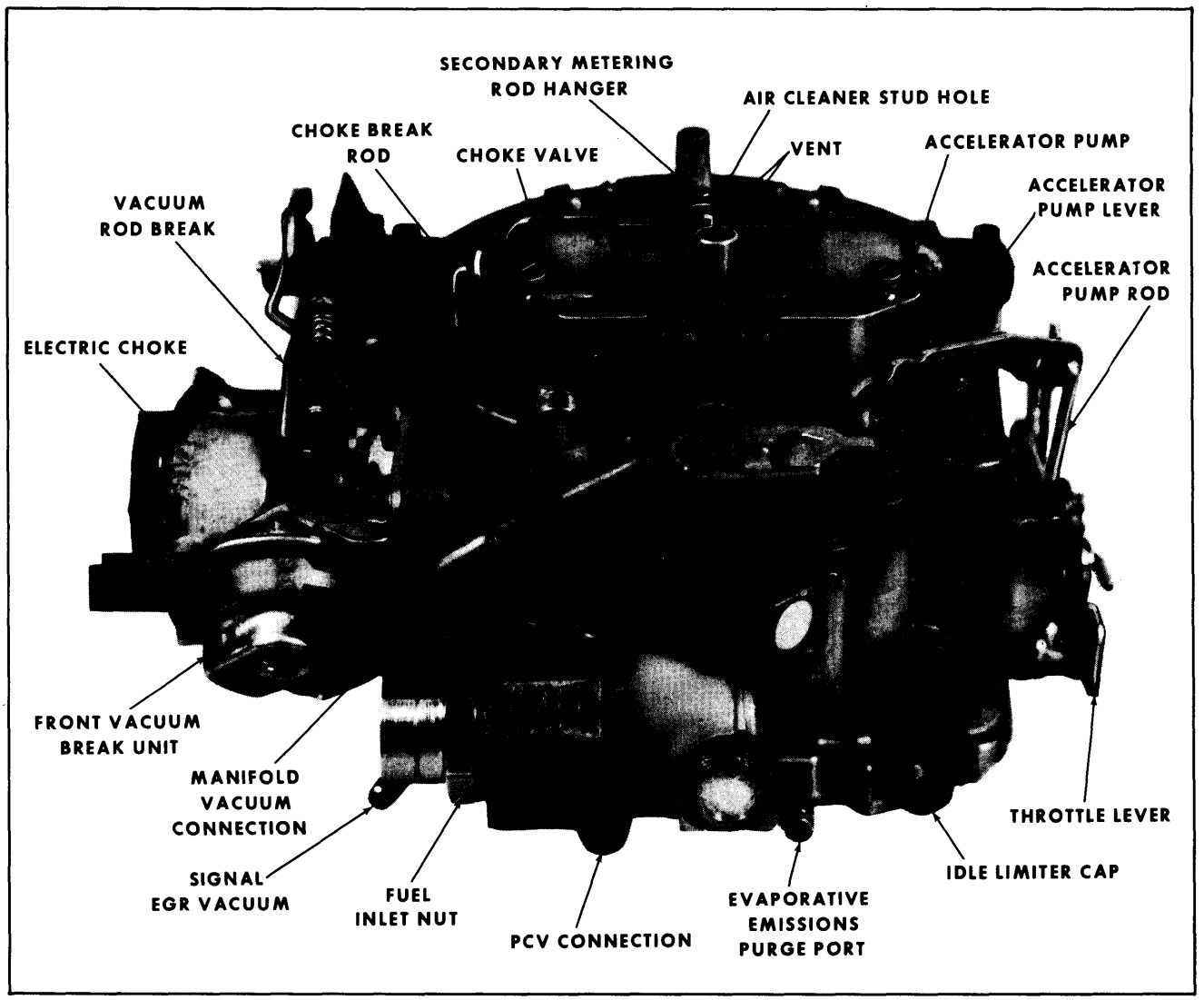


Fig. 6-67 Quadrajet Carburetor

of other carburetors using the venturi principle. The triple venturi stack up, plus the smaller primary bores, give an excellent fuel control in the idle and economy ranges of operation. Fuel metering in the primary side is accomplished with metering rods, operating in main metering jets, positioned by a power piston responsive to manifold vacuum. The secondary side has two very large bores to supplement air and fuel flow from the primary bores. The air valve principle is used in the secondary side for metering control, which means that fuel is metered in direct proportion to the air passing through the secondary bores.

The fuel reservoir (float bowl) is centrally located. The float system uses a single pontoon float. The float needle has a synthetic tip which gives added protection against flooding problems caused by dirt.

Idle mixture adjustment limiter caps are used on the idle mixture screws. The plastic limit caps permit idle mixture screws to be adjusted approximately 1/2 turn leaner without breaking the cap. At 24,000 miles, if CO is high, the mixture may be adjusted within the limits of the caps.

Idle limiter caps should never be altered or removed, to do so may cause complaints of exhaust odor from excessively rich idle mixtures.

The fuel tank is not vented to atmosphere. All fuel vapors are collected in a vapor canister. Purge ports to remove the fuel vapors from the collection canister are provided in the carburetor throttle body. Purging is varied by a timed port positioned above the throttle valves and is controlled by the amount of primary throttle valve opening.

A timed vacuum signal for the Exhaust Gas Recirculation (E.G.R.) valve is taken from ports in the carburetor throttle body. Vertical and horizontal ports located above the right primary throttle valve provide the vacuum signal for positioning of the E.G.R. Valve dependent upon the amount of primary throttle valve opening. Carburetors used on California vehicles have only the horizontal port.

The choke housing and electric choke assembly are mounted on the carburetor float bowl. A dual vacuum break system is used for improved choke operation during the warm-up period.

BACK TO INDEX

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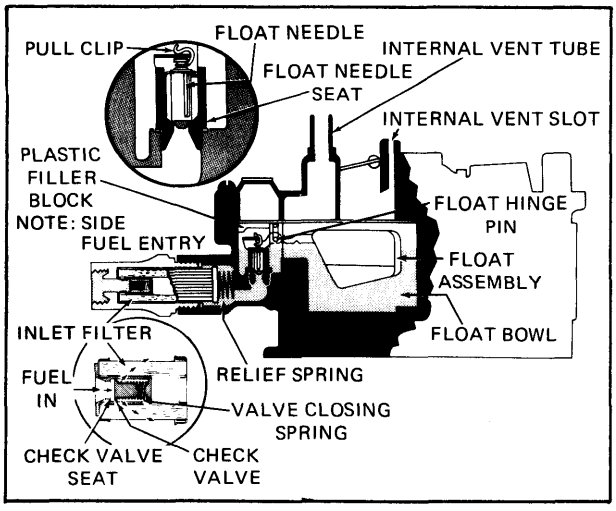


Fig. 6-68 Float System

Float System (Fig. 6-68)

The float system incorporates a fuel inlet filter check valve to shut off fuel flow to the carburetor float bowl to meet M.V.S.S. (Motor Vehicle Safety Standards) to prevent fuel loss during vehicle roll-over.

The fuel filter check valve is located behind the fuel inlet filter nut and is an integral part of the fuel filter.

The check valve consists of a plastic valve located in a viton retainer. It is held in the normally closed position by a small spring which exerts pressure on the check valve. The check valve retainer also has a flanged neck which seals between the filter and fuel inlet nut. This replaces the fibre seal which was previously used on the end of the filter assembly. The float system operates in the following manner:

When the engine starts and fuel flow pressure from the fuel pump enters the inlet nut, it pushes the small check valve off its seat.

Fuel flows past the valve into the inside of the filter and continues on through the filter to the float needle and seat and on into the float bowl chamber. As the incoming fuel fills the float bowl to the prescribed level, the float pontoon rises and forces the float needle against the seat, shutting off fuel flow. As fuel is used from the float bowl, the float drops allowing the float needle to open, when more fuel again fills the bowl. This cycle continues, maintaining a constant fuel level in the float bowl.

With the engine off, the check valve closes and shuts off fuel flow to the carburetor preventing excessive fuel flow from the fuel lines and tank, thereby achieving the required roll-over safety standards. The float pontoon is solid and is made of a lightweight closed cell plastic material. This feature gives added buoyancy to allow the use of a single float to maintain constant fuel levels. A float pull clip, fastened to the float valve, hooks over the edge of the float arm at the center as shown in Fig. 6-68. Its purpose is to assist in lifting the float valve off its seat whenever fuel level in the float bowl is low.

CAUTION: Do not place pull clip through small holes in top of float arm. Severe flooding will result.

No side windows are used in the float valve seat so that all fuel will be discharged over the top of the float valve seat. This provides a smoother flow of fuel through the float valve seat to control fuel turbulence in the float bowl.

The carburetor float chamber is internally vented by a vertical slot, cast in the air horn, located at the rear of the primary venturis, and by a pressed-in vent tube located at the front of the air horn. The purpose of the vertical vent slot and vent tube is to balance air pressure acting on the fuel in the float bowl with air flow through the carburetor bores. In this way, balanced air/fuel ratios are maintained throughout all ranges of carburetor operation. Also, during periods of hot engine operation, the vents are used to relieve vapor pressure that builds up in the float bowl, thereby preventing the pushing of raw fuel through the discharge nozzles into the engine to cause hard hot restarts.

Idle System (Fig. 6-69)

Each primary bore of the Quadrajet carburetor has a separate and independent idle system to supply the correct air/fuel mixture ratios during idle and off-idle operation. The idle system is used during this period because air flow through the carburetor venturi is not great enough to obtain efficient metering from the main discharge nozzles.

The idle system operates as follows:

During curb idle, the throttle valves are held slightly open by the solenoid. The small amount of air passing between the throttle valves and bores is regulated by this solenoid to give the engine the desired idle speed. Since the engine requires very little air for idle and low speeds, the fuel is added to the air to produce a combustible mixture by the direct application of vacuum (low pressure) from the engine manifold to the idle discharge holes below the throttle valves. With the idle discharge holes in a very low pressure area and the fuel in the float bowl vented to atmosphere (high pressure), the idle system operates as follows:

Fuel flows from the float bowl down through the main metering jets into the main fuel wells. It is picked

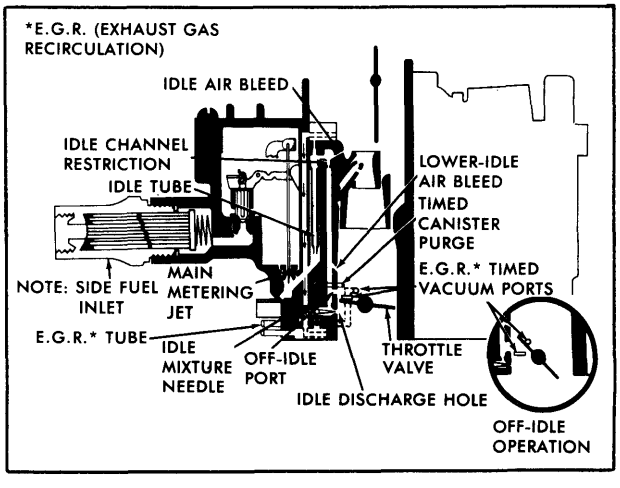


Fig. 6-69 Idle System

BACK TO INDEX

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up in the main wells by the two idle tubes (one for each bore) which extend into the wells. The fuel is metered at the lower tip of each idle tube and passes up through the tube. The fuel is mixed with air at the top of each idle tube through an idle air bleed.

Then the fuel mixture crosses over to the idle down channels where it is mixed with air at the side idle bleed located just above the idle channel restriction. The mixture continues down through the calibrated idle channel restrictions past the lower idle air bleeds and off-idle discharge ports where it is further mixed with air. The air/fuel mixture moves down to the idle mixture needle discharge holes where it enters the carburetor bores and blends with the air passing the slightly open throttle valves. The combustible air/fuel mixture then passes through the intake manifold to the engine cylinders.

The idle mixture needls are adjusted at time of manufacture to achieve the correct idle air/fuel ratio. Then limiter caps are installed to prevent idle mixture readjustment. Tampering with idle mixture may cause exhaust odor complaints.

M4ME-M4MEA carburetor models have a fixed idle air bypass system. This consists of air channels which lead from the top of each carburetor bore in the air horn to a point below each throttle valve. At normal idle, extra air passes through these channels supplementing the air passing by the slightly opened throttle valves. The purpose of the idle air bypass system is to allow reduction in the amount of air going past the throttle valves so they can be nearly closed at idle. This reduces the amount of air flowing through the carburetor venturi to prevent the main fuel nozzles from feeding during idle operation.

As the primary throttle valves are opened from curb idle to increase engine speed, they pass by the off-idle ports, gradually exposing them to high engine vacuum below the throttle valves. The additional fuel added from the off-idle ports mixes with the increasing air flow past the opening throttle valves to meet increased engine air and fuel demands.

Further opening of the throttle valves increases the air velocity through the carburetor venturi sufficiently to cause low pressure at the lower idle air bleeds. As a result, fuel begins to discharge from the lower idle air bleed holes and continues to do so throughout operation of the part throttle to wide open throttle ranges, supplementing the main discharge nozzle delivery.

Main Metering System (Fig. 6-70 and 6-71)

The main metering system supplies fuel to the engine from off-idle to wide-open throttle.

The main metering system on all models (except the M4MEA altitude option) is designed so that separate main wells feed each fuel nozzle for improved fuel flow in the venturi system. The main metering system operates as follows:

As the primary throttle valves are opened beyond the off-idle range allowing more air to enter the engine, air velocity increases in the carburetor venturi causing fuel from the float bowl to flow between the main metering rods and jets into the main fuel wells. It passes upward in the main well and is mixed with air from air bleeds located at the top and side of the well. The air-fuel mixture then passes from the main well through the main discharge nozzles into the boost venturi. At the boost venturi, the fuel mixture then combines with the air entering the engine through the carburetor bores. It then passes as a combustible mixture through the intake manifold and on into the engine cylinders.

The main metering system is calibrated by tapered metering rods operating in metering jets.

Primary Power Piston

The primary (main) metering rods are connected to a manifold vacuum responsive piston which operates against a calibrated spring. Engine manifold vacuum is supplied through a vacuum passage to the chamber beneath the power piston. Under cruising and light load conditions, when the engine vacuum is high, the piston is held down and the larger diameter of the metering rods are in the metering jet orifice. This results in lean mixtures for economical operation. As engine load increases, manifold vacuum drops and the spring force acting on the bottom of the power piston overcomes the vacuum pull and lifts the metering rods partially out of the main metering jets. This enrichens the fuel mixture to supply additional power.

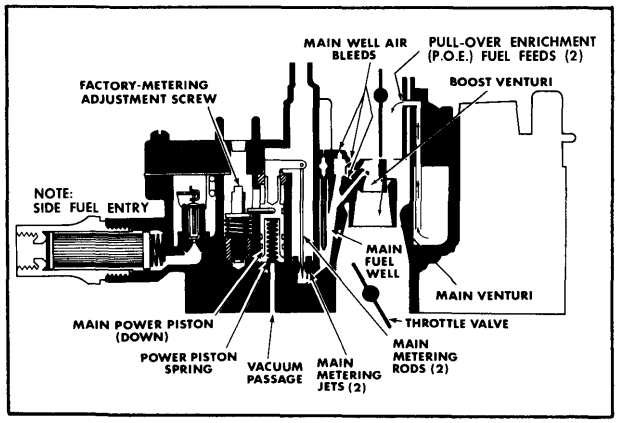


Fig. 6-70 Main Metering System

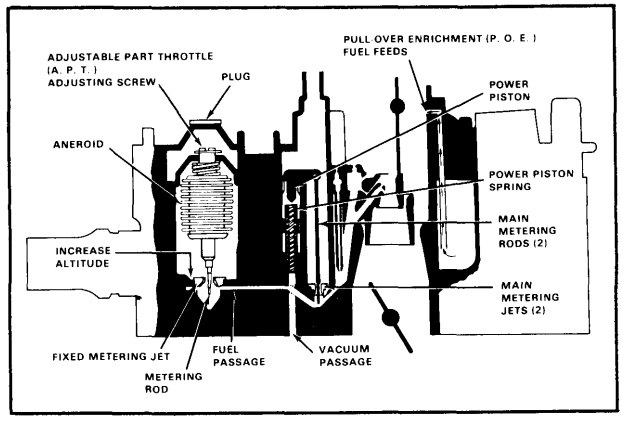


Fig. 6-71 Main Metering System (Altitude Option)

BACK TO INDEX

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Adjustable Part Throttle (A.P.T.)

In order to provide a close tolerance adjustment in the main metering system, an adjustment is provided to very accurately set the depth of the metering rods in the main metering jets.

On M4ME (non-altitude) models (Fig. 6-70), the adjustment feature consists of a pin pressed in the side of the power piston which extends through a slot in the side of the piston well. When the power piston is down (economy position) the side of the pin stops on top of a flat surface on the adjustment screw located in the cavity next to the power piston. The adjustment screw is held from turning by a tension spring beneath the head of the adjustment screw.

During production flow test, the adjustment screw is turned up or down which, in turn, raises or lowers the power piston and metering rod assembly. This very accurately controls the fuel flow between the rods and jets to meet emission requirements.

On M4MEA altitude option models (Fig. 6-71), an adjustable aneroid-metering rod assembly is used to provide close tolerance control of fuel flow to the main metering system during part throttle operation. (For an explanation of aneroid, see Altitude Compensation). The metering rod, with aneroid, is adjusted at time of manufacture by turning the threaded aneroid-metering rod assembly, up or down to position the metering rod in a fixed metering jet located at the bottom of the fuel reservoir in the float bowl. This sets the part throttle air/fuel mixture to the desired flow band.

CAUTION: No attempt should be made to change the A.P.T. adjustment in the field. If float bowl replacement is required on M4ME models, the new bowl assembly will include an adjustment screw pre-set by the factory. If replacement of the aneroid-metering rod assembly is required on M4MEA models, the threaded A.P.T. metering rod assembly should be readjusted carefully following adjustment procedures provided.

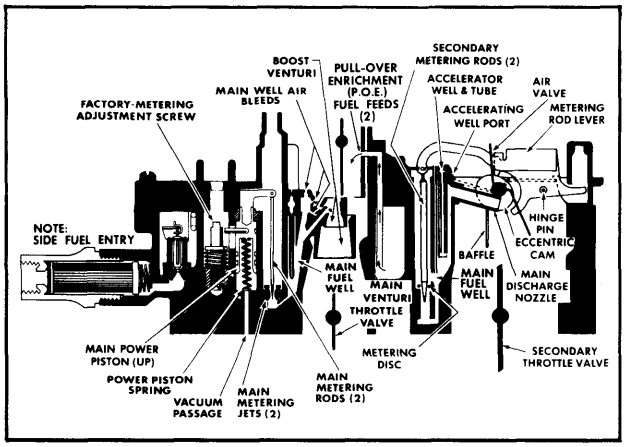


Fig. 6-72 Power System

Altitude Compensation (M4MEA Models Only)

A barometric pressure-sensitive aneroid (sometimes called a "bellows") is included as an integral part of the threaded A.P.T. metering rod assembly, The aneroid, being sensitive to air pressure change (such as caused by a change in elevation), expands or contracts to position the metering rod in the fixed metering jet. In this way, the aneroid maintains control of part throttle air/fuel ratios.

(NOTE: The position of the A.P.T. metering rod in the fixed jet is extremely critical. Adjustment should NEVER be attempted unless a replacement is required. The threaded A.P.T. metering rod should be readjusted carefully following adjustment procedures provided. (See Note 20, Page 6-35.)

Pull-Over Enrichment (P.O.E.)

A fuel pull-over enrichment (P.O.E.) circuit is used on all models to supply the extra fuel needed at higher engine speeds for good performance.

Two calibrated holes, one for each primary bore, are located just above the choke valve and are supplied fuel from the float bowl. Under high air flow conditions, air velocity generates a vacuum at the P.O.E. feed holes, pulling fuel from the float bowl.

Secondary System

At maximum engine load, the primary side of the carburetor can no longer meet the engine air and fuel requirements, to meet these demands, the secondary side of the carburetor is used.

As the secondary throttle valves are opened, engine manifold vacuum (low pressure) is applied directly beneath the air valves. Atmospheric pressure on top of the air valves forces the air valves to open against spring tension and allows metered air to pass through the secondary bores of the carburetor.

When the secondary air valves begin to open, the accelerating well ports are exposed to vacuum. The ports immediately start to feed fuel from the accelerating wells and continue to feed fuel until the fuel in the well is gone. This prevents a momentary leanness as the air

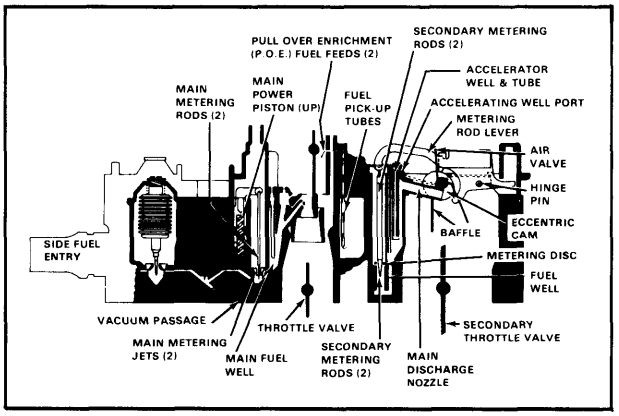


Fig. 6-73 Power System (Altitude Option)

BACK TO INDEX

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valve opens and before the secondary nozzles begin to feed fuel.

As the air valves open, a plastic eccentric cam attached to the center of the air valve shaft rotates and, through the metering rod lever, lifts the secondary metering rods out of the secondary orifice plates. The fuel mixture travels from the main wells through the secondary discharge nozzles where it sprays into the secondary bores supplementing the air/fuel mixture delivered from the primary bores. In this way, correct air/fuel mixtures through the secondary bores are controlled by the position of the metering rods in the orifice plates.

There are other features incorporated in the secondary metering system as follows:

1. The main well bleed tubes extend below the fuel level in the main well. These bleed air into the fuel in the well to quickly emulsify the fuel with air for good atomization as it leaves the secondary discharge nozzles.
2. Two baffle plates are used, on in each secondary bore. They extend up and around the secondary fuel discharge nozzles. Their purpose is to provide good fuel distribution at lower air flows by preventing too much fuel from going to the front of the engine.

Operation of Air Valve Dashpot

The air valve dashpot operates off of the front vacuum break diaphragm unit. The secondary air valve is connected to the vacuum break unit by a rod, to control the opening of the air valve. This delays the air valve opening rate to prevent secondary discharge nozzle "lag".

Whenever manifold vacuum is above approximately 5" to 6" Hg. the vacuum break diaphragm is seated (plunger is fully inward) against spring tension. At this point, the vacuum break rod is in the forward end of the slot in the air valve lever and the air valves are closed.

During acceleration or heavy engine loads, when the secondary throttle valves are open, the manifold vacuum drops. The spring located in the vacuum break diaphragm overcomes the vacuum pull and forces the plunger and link outward which, in turn, allows the air valves to open. The opening rate of the air valves is controlled by the calibrated restriction in the vacuum inlet nipple in the diaphragm cover. This gives the dashpot action required to delay air valve opening enough for efficient fuel flow from the secondary discharge nozzles.

Accelerating Pump System (Fig. 6-74)

During quick acceleration when the throttle is opened rapidly, the air flow and manifold vacuum change almost instantaneously. The fuel, which is heavier, tends to lag behind causing a momentary leaness. The accelerator pump is used to provide the extra fuel necessary for smooth operation during this time.

The accelerating pump system consists of a spring loaded pump plunger and pump return spring, operating in a fuel well. The pump plunger is operated by a pump lever on the air horn which is connected directly to the throttle lever by a pump rod.

When the pump plunger moves upward in the pump well, as happens during throttle closing, fuel from the float bowl enters the pump well through an opening in the side of the pump well. The pump cup is the floating type. (The cup moves up and down on the pump plunger head - see inset.) When the pump plunger is moved upward, the flat on the top of the cup unseats from the flat on the plunger head and allows free movement of fuel through the inside of the cup into the bottom of the pump well. This also vents any vapors which may be in the bottom of the pump well so that a solid charge of fuel can be maintained in the fuel well beneath the plunger head.

When the throttle valves are opened, the connecting linkage forces the pump plunger downward. The pump cup seats instantly and fuel is forced through the pump discharge passage where it unseats the pump discharge check ball and passes on thorugh the passage to the pump jets, located in the air horn, where the fuel sprays into the venturi of each bore.

An expander (garter) spring, located beneath the pump plunger cup, is used in maintaining constant pump cup to pump wall contact for good pump fuel delivery.

The pump plunger is spring loaded – the upper duration spring is balanced with the bottom pump return spring so that a smooth sustained charge of fuel is delivered during acceleration.

The pump discharge check ball seats in the pump discharge passage during upward motion of the pump plunger so that air will not be drawn into the passage; otherwise, a momentary lag in acceleration could result.

During high speed operation, a vacuum exists at the pump jets. A cavity just beyond the pump jets is vented to the top of the air horn, outside the carburetor bores. This acts as a suction breaker so that when the pump is not in operation, fuel will not be pulled out of the pump jets into the venturi area. This insures a full pump stream when needed and prevents any fuel "pull-over" from the pump discharge passage.

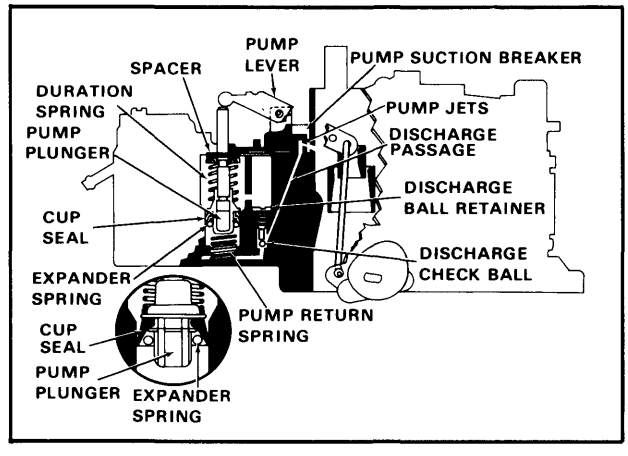


Fig. 6-74 Accelerating Pump System

BACK TO INDEX

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Choke System (Fig. 6-75)

An electric choke assembly is installed in a choke housing mounted on the carburetor float bowl. Front and rear vacuum break units also control choke operation.

The choke system operates as follows:

The thermostatic coil in the choke housing is calibrated to hold the choke valve closed when the engine is cold.

To close the choke valve, depress the accelerator pedal completely to allow the fast idle cam follower lever to clear the steps on the fast idle cam. At this point, the thermostatic coil will rotate the choke valve to the closed position and the fast idle cam to the top step.

During engine cranking, the closed choke valve restricts air flow through the carburetor to provide a rich starting mixture.

When the engine starts and is running, manifold vacuum is applied to both vacuum break diaphragm units mounted on the side of the float bowl.

The front vacuum break diaphragm opens the choke valve to prevent loading (stalling rich). When the choke valve moves to the vacuum break position, the fast idle cam will drop from the high step to the second step when the throttle is opened.

As the engine manifold is wetted and friction decreases after start, the rear vacuum break gradually opens the choke valve a little further to prevent stalling.

The rear vacuum break diaphragm unit includes a tension (bucking) spring in the diaphragm plunger head to off-set tension of the thermostatic coil. The bucking spring assists in controlling choke valve opening through the thermostatic coil so that leaner mixtures (large choke openings) are maintained during warmer temperatures and richer mixtures (small choke opening) during colder temperatures.

The rear vacuum break unit is delayed in operation by an internal bleed check valve. The bleed check valve delays further opening of the choke valve a few seconds until the engine will run at slightly leaner mixtures. At this point, further choke valve opening is controlled by air flow against the off-set choke valve and the thermostatic coil.

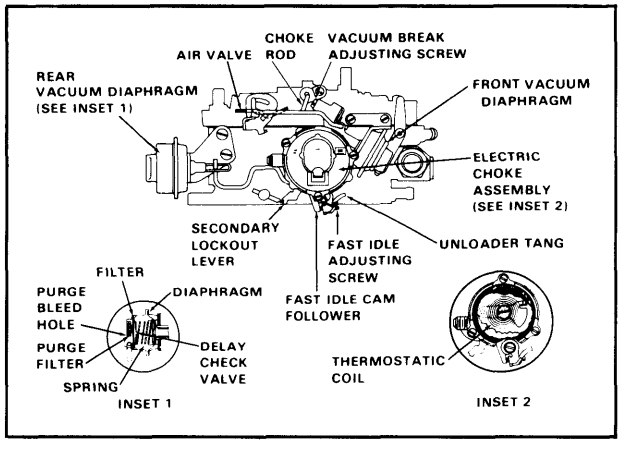


Fig. 6-75 Choke System

A clean air purge feature is added to the rear vacuum break diaphragm unit. A filter element is installed internally with a small bleed hole located in the end cover of the diaphragm unit.

During engine operation, vacuum acting upon the diaphragm unit pulls a small amount of filtered air through the bleed hole to purge the system of any fuel vapors or dirt contamination which might be pulled into the bleed check valve located inside the diaphragm unit.

An electrically actuated ceramic resistor in an electric choke assembly heats the thermostatic coil to allow the choke valve to reach its wide open position somewhat before the fast idle cam drops off its third step. In this way, the choke valve is opened quickly, yet the idle speed is maintained sufficiently high to prevent stalling.

The secondary throttle valves are locked out during choke operation and the engine warm-up period. As the choke opens, the fast idle cam drops down and moves the secondary throttle valve lock-out lever away from the secondary throttle valve lock-out pin. This allows the secondary throttle valves to operate normally.

The choke system is equipped with an unloader feature which is designed to open the choke valve partially, should the engine become flooded or loaded. To unload the engine, the accelerator pedal must be depressed to the floor so that the throttle valves are held wide open.

A tang on the lever on the choke side of the primary throttle shaft contacts the fast idle cam and through the intermediate choke shaft forces the choke valve slightly open. This allows extra air to enter the carburetor to lean out the fuel mixture so that the engine will start.

Exhaust Gas Recirculation (E.G.R.)

An Exhaust Gas Recirculation (E.G.R.) system is used on all models to control oxides of nitrogen (NOx) emissions. Federal models use a ported vacuum E.G.R. system, in which the E.G.R. valve is operated by a vacuum signal taken from the carburetor. Two punched ports, one located just above the throttle valve and the other near the upper edge of the throttle body casting, provide a timed vacuum signal port for E.G.R. valve operation in the off-idle and part throttle ranges of the carburetor.

The purpose of the E.G.R. system is to supply a metered amount of exhaust gases to the combustion mixtures and lower combustion temperatures, thereby reducing oxides of nitrogen during these ranges of engine operation.

The port system operates as follows:

As the throttle valve is opened beyond the idle position the first vacuum port for the E.G.R. system is exposed to manifold vacuum to supply a vacuum signal to the E.G.R. Valve. To control the vacuum signal at the lower port, the upper port bleeds air into the vacuum channel and modulates the amount of vacuum signal supplied by the lower E.G.R. port. In this manner, the E.G.R. valve can be timed for precise metering of exhaust gases to the intake manifold, dependent upon

BACK TO INDEX

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location of the ports in the carburetor bore and degree of throttle valve opening.

As the throttle valves are opened further in the part throttle range, the upper port ceases to function as an air bleed and is gradually exposed to manifold vacuum to supplement the vacuum signal at the lower port and maintain correct E.G.R. valve position.

The upper and lower vacuum ports connect to a cavity in the throttle body which, in turn, through a passage, supply the vacuum signal to an E.G.R. tube pressed into the front corner of the throttle body casting (Code "J"). The tube in the throttle body is connected by a hose to the E.G.R. valve located on the intake manifold.

The E.G.R. valve remains closed during periods of engine idle and deceleration to prevent rough idle, which could be caused from excessive exhaust gas in the idle air/fuel mixtures.

Canister Purge

Since the fuel tank is vented to the vapor canister, a purge system is used to meter vapors back into the engine. The purge system consists of a hose from the canister to the K tube in the throttle body, then to two purge port orifices located above the throttle valves, one in each primary bore.

Electric Choke Assembly (Fig. 6-76)

As mentioned earlier, a ceramic resistor in the electric choke assembly is heated by an electric current and the resistor warms the thermostatic coil for precise timing of choke valve opening for good engine warm-up performance.

The electric choke operates as follows:

The electric choke receives an electric current operating through the engine oil pressure switch whenever the engine is running. The electric current flows to a ceramic resistor that is divided into separate sections - a small center section for gradual heating of the thermostatic coil, and a large outer section for additional rapid heating of the thermostatic coil.

The ceramic resistor functions as follows:

Air Temperature Below 50° F, (10° C)

Electric current, applied to the small section of the ceramic resistor causes the section to heat up and warm

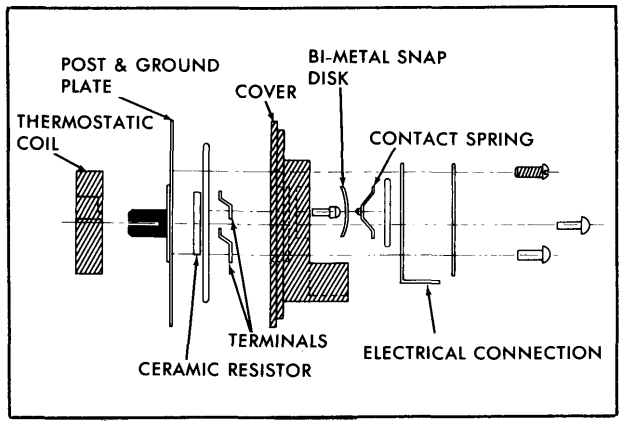


Fig. 6-76 Electric Choke Assembly

the thermostatic coil which allows gradual opening of the choke valve for good cold engine warm-up performance. As the small section of the ceramic resistor continues to produce heat, a temperature-sensitive bi-metal disk causes a spring loaded contact to close also applying electric current to the large section of the ceramic resistor causing the large section to heat up. Heat from the larger section of the ceramic resistor increases the rate of heat flow to the thermostatic coil for more rapid opening of the choke valve.

Air Temperature 70° F (21° C) and Above

Electric current is applied directly to both the small section, and through the spring contact, to the large section of the ceramic resistor to provide a rapid heating of the thermostatic coil for greater choke valve opening when leaner air/fuel mixtures are desired at warmer ambient temperatures.

(NOTE: Ground contact for the electric choke is provided by a metal plate located at the rear of the choke assembly. DO NOT INSTALL A CHOKE COVER GASKET BETWEEN THE ELECTRIC CHOKE ASSEMBLY AND THE CHOKE HOUSING.)

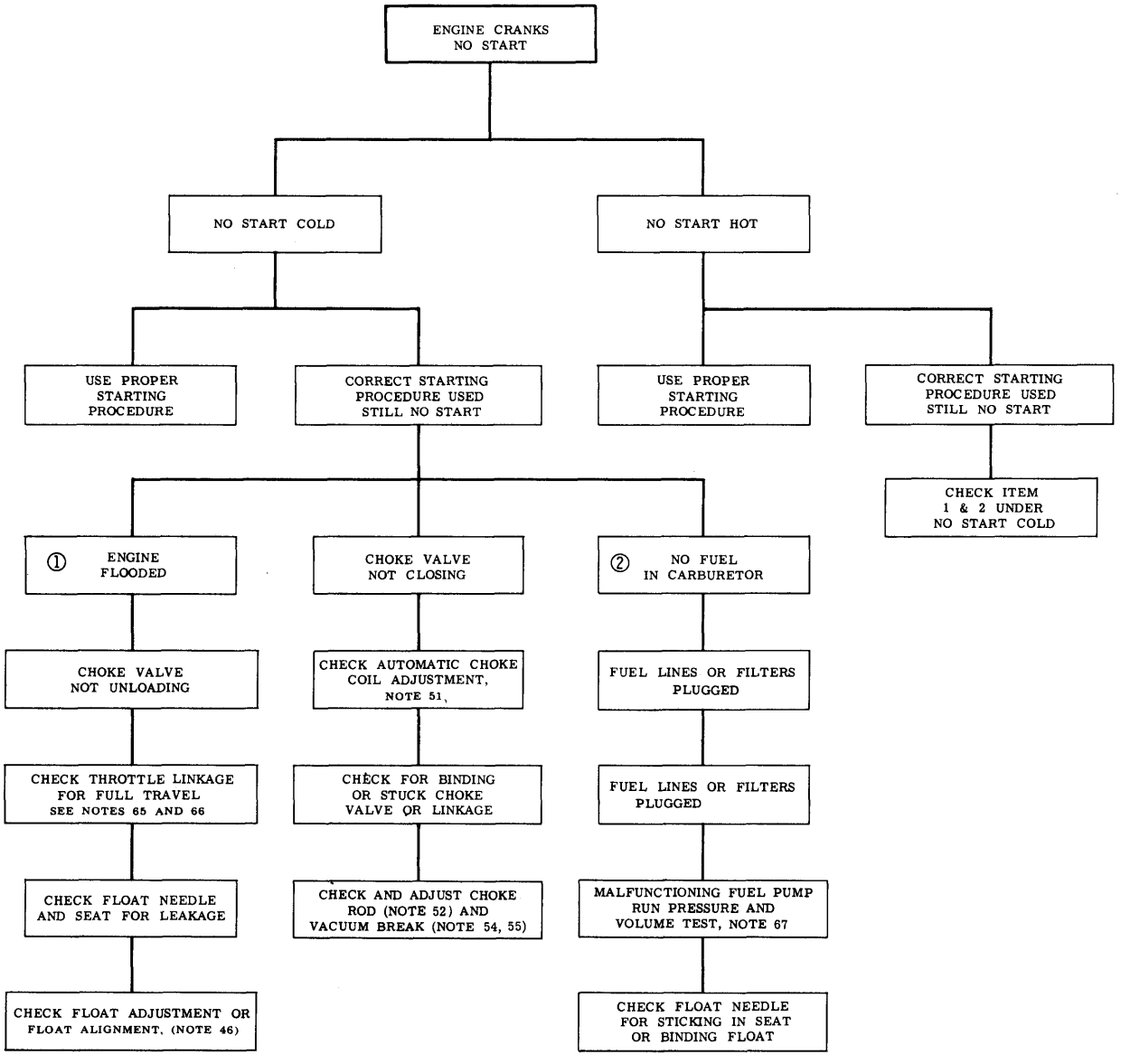
The electric choke assembly is indexed properly by aligning the scribe mark on the front cover with the specified index mark on the choke housing. (See Adjustments, page 6-78).

The electric choke and thermostatic coil are serviced as a complete assembly and may be checked as described in Note 63.

BACK TO INDEX

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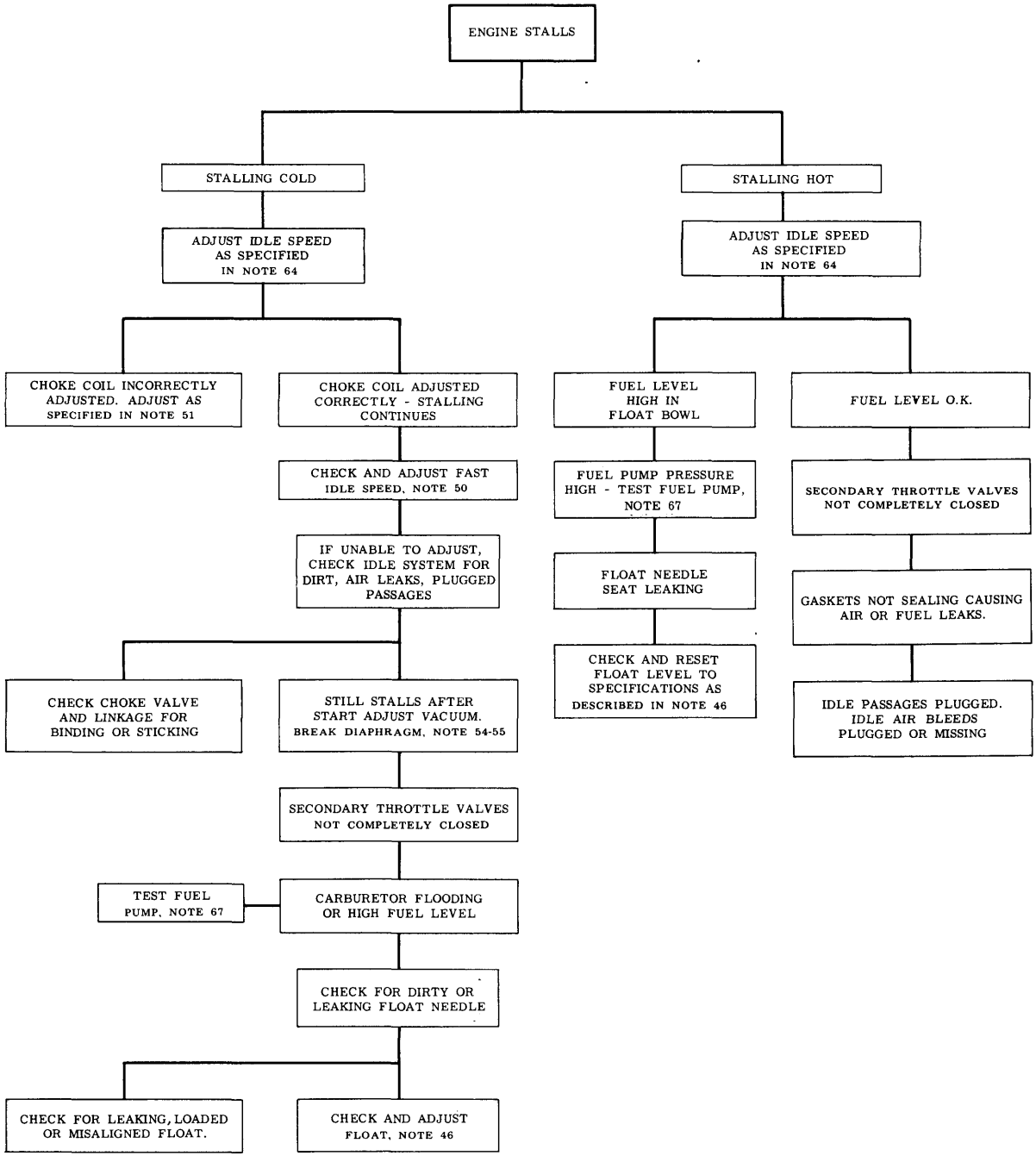
QUADRAJET 4MV
CARBURETOR DIAGNOSIS CHART



BACK TO INDEX

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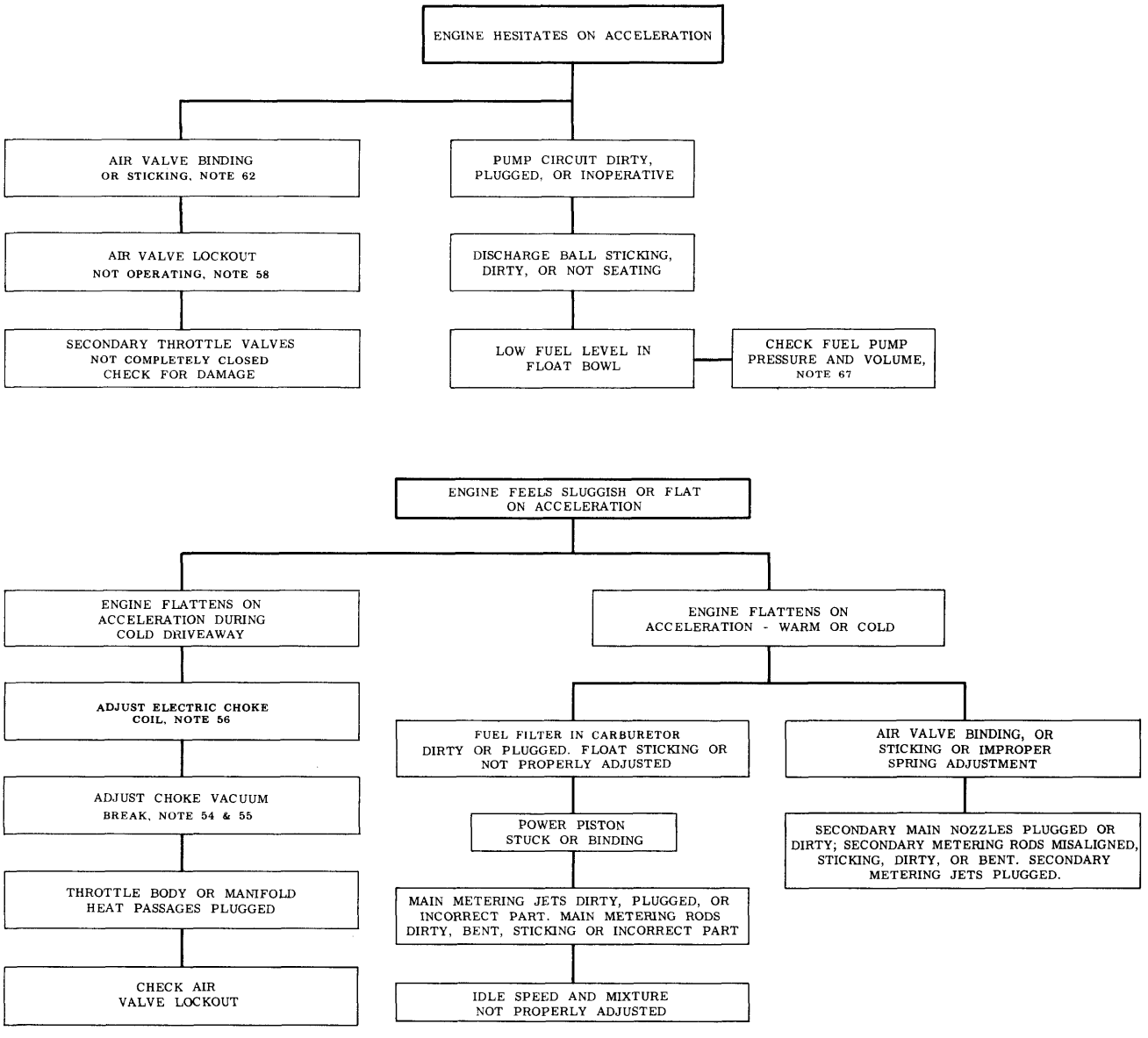
QUADRAJET 4MV
CARBURETOR DIAGNOSIS CHART (Cont'd.)



BACK TO INDEX

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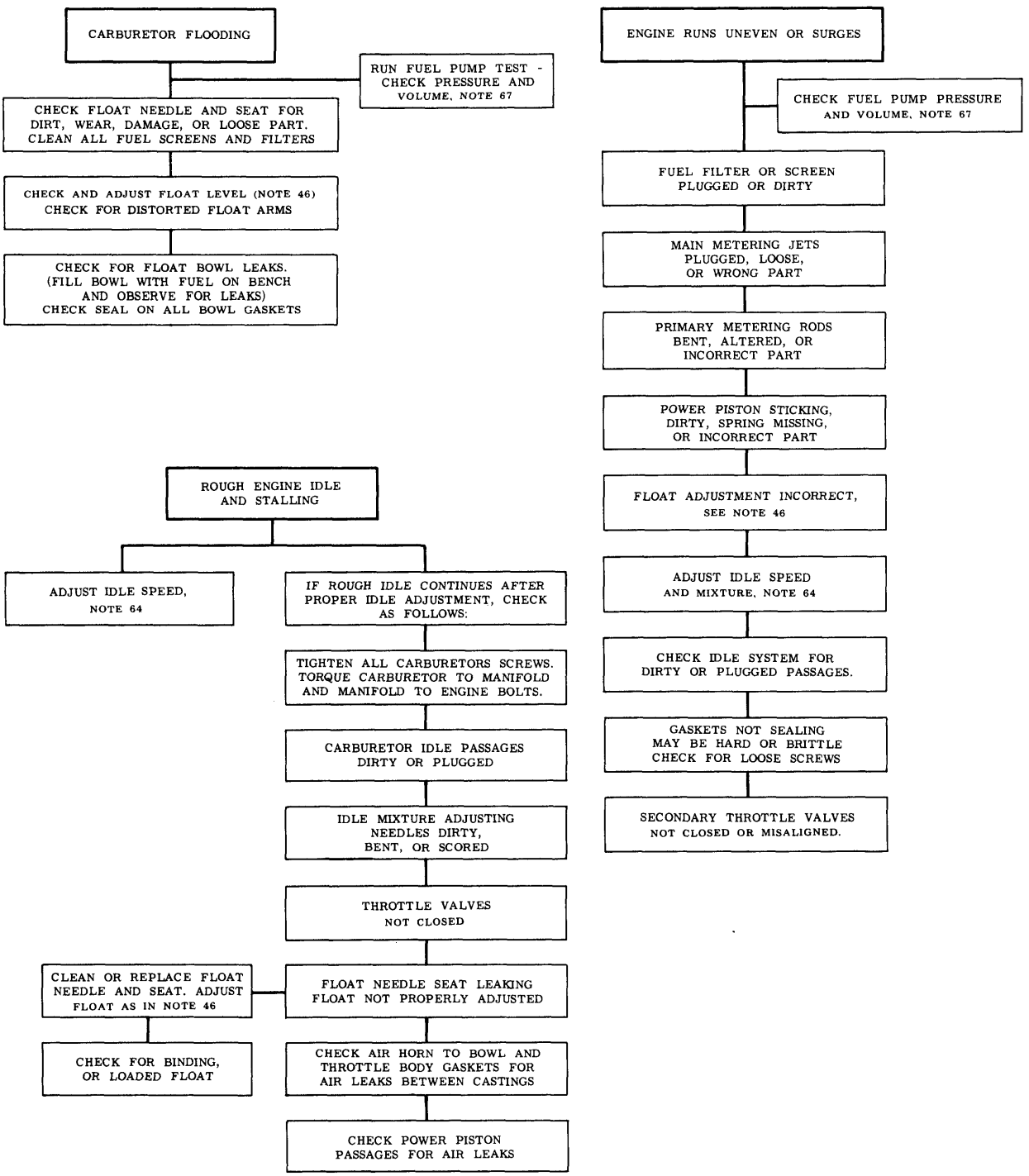
QUADRAJET 4MV
CARBURETOR DIAGNOSIS CHART (Cont'd.)



BACK TO INDEX

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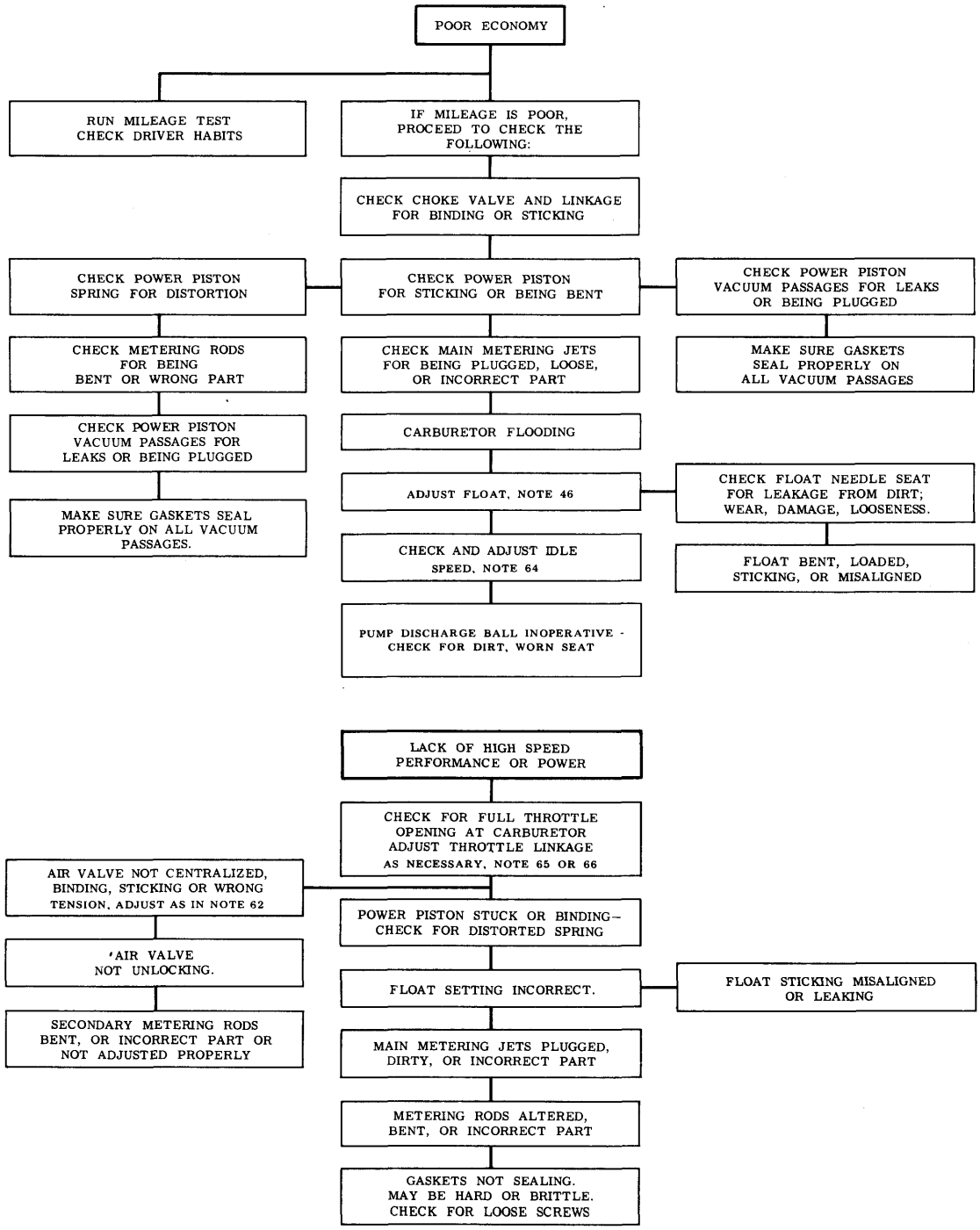
QUADRAJET 4MV
CARBURETOR DIAGNOSIS CHART (Cont'd.)



BACK TO INDEX

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QUADRAJET 4MV
CARBURETOR DIAGNOSIS CHART (Cont'd.)



BACK TO INDEX

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SERVICE INFORMATION

43. Carburetor Removal and Installation

a. Removal

1. Remove air cleaner and disconnect electrical lead to choke.
2. Disconnect distributor vacuum advance hose from vacuum break tee.
3. Disconnect hoses at EGR (J), and purge (K) nipples on front of carburetor.
4. Disconnect throttle linkage and cruise control linkage if so equipped.
5. Working at rear of carburetor, remove transmission modulator hose(D) and using a back-up wrench, remove power brake vacuum pipe.
6. Always remove front vacuum break unit to avoid altering the vacuum break setting when breaking the fuel line nut.
7. Remove fuel line using a back-up wrench or tool J-23443 as required.
8. Remove mounting screws and lift carburetor to a position where PCV hose may be removed and remove carburetor.
9. Discard carburetor gasket.

b. Installation

1. Clean mounting surface of intake manifold and carburetor of any dirt, carbon or gasket material.
2. Place a new carburetor gasket on manifold with side marked "Top" or with manufacturers trade mark facing up.
3. Position carburetor near manifold and connect PCV hose to nipple "L" on the throttle body. Secure with clamp.
4. Position carburetor to manifold and downshift switch and secure with four screws. Tighten screws evenly to 8 foot-pounds in front and 12 foot-pounds in rear.
5. Install fuel line using a tubing wrench.
6. Install front vacuum break unit.
7. Install the following hoses as indicated:

(NOTE: Vacuum hose routing is shown in Fig. 77).

a. EGR hose to nipple "J".
b. Canister purge hose to nipple "K".
c. Transmission modulator hose to nipple "D".
d. Distributor vacuum advance hose to vacuum break "Tee" (Nipple "A").
e. Power brake vacuum pipe fitting (port "V").

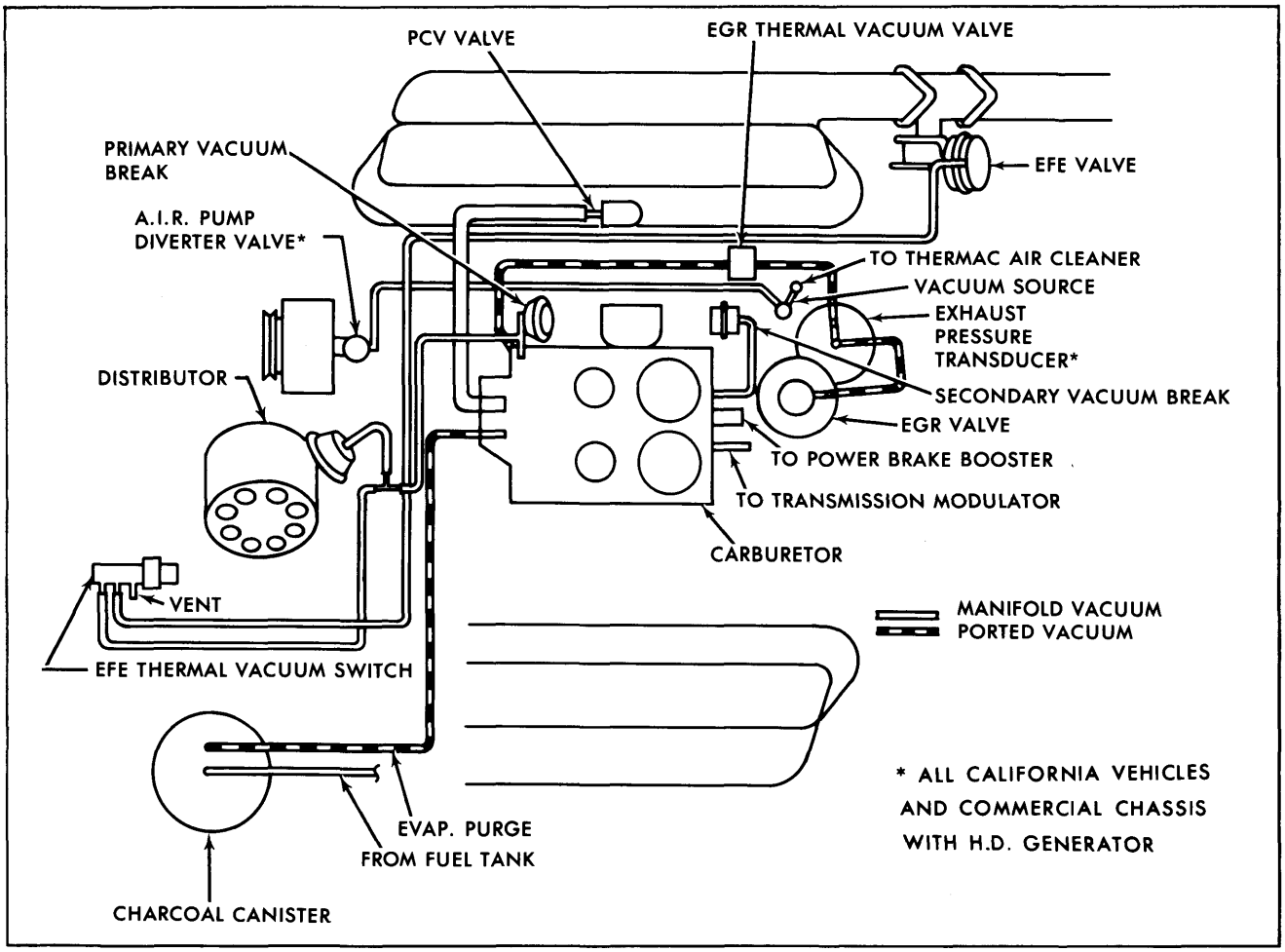


Fig. 6-77 Vacuum Hose Routing

BACK TO INDEX

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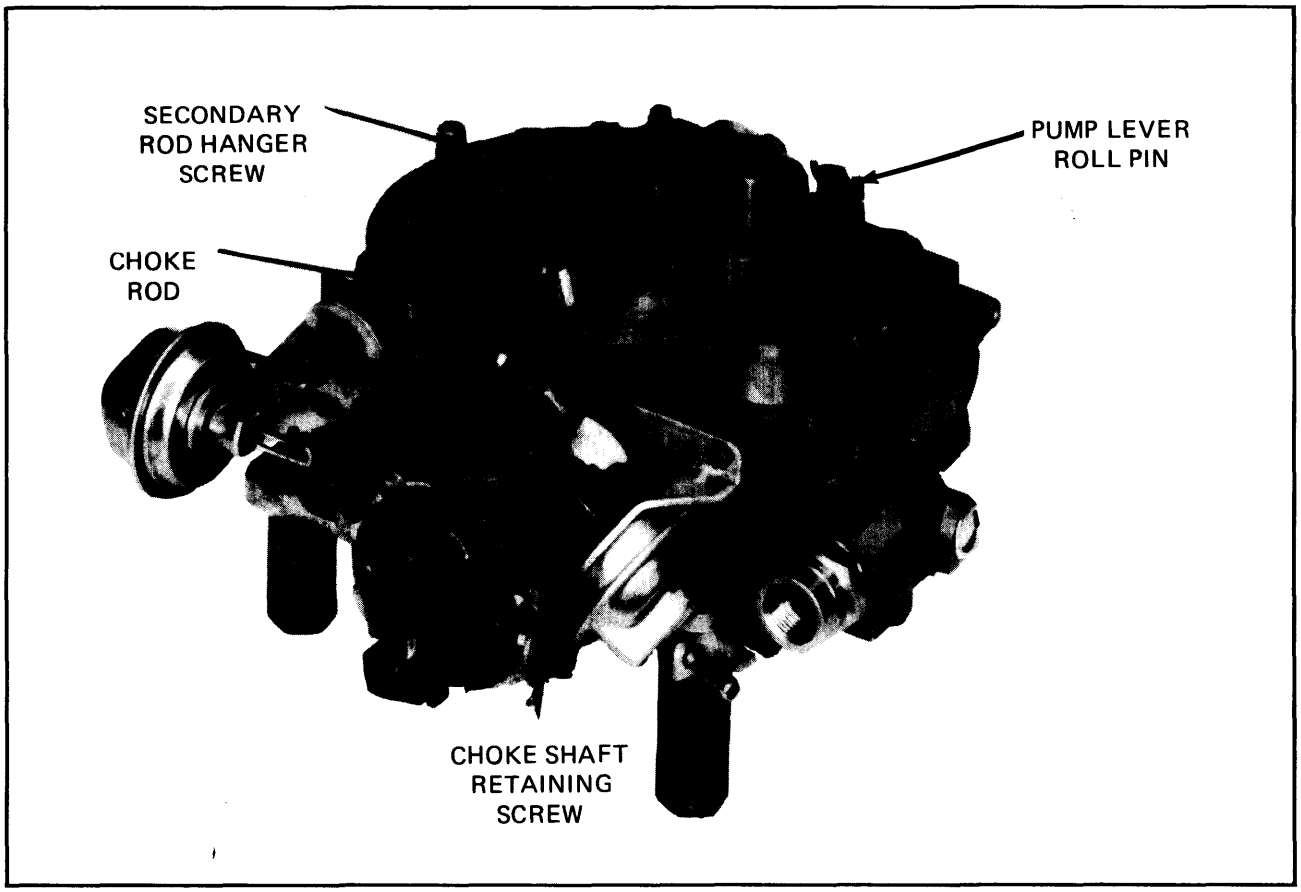


Fig. 6-78 Removing Air Horn

(NOTE: If inverted flare tube connector in throttle body has been loosened or replaced, do not tighten to greater than 125 inch-pounds as distortion of the throttle body may occur.)

8. Connect throttle linkage and return spring. Connect cruise control linkage on cars so equipped.
9. Connect electrical lead to choke coil.
10. Install air cleaner.

44. Carburetor Disassembly

(NOTE: Before performing any service on the carburetor, it is essential that the carburetor be placed on a holding fixture such as J-8328-1. Without the use of the holding fixture it is possible to bend or nick throttle valves.)

a. Air Horn Removal

1. Remove upper choke lever from the end of choke shaft by removing retaining screw, Fig. 6-78. Then rotate upper choke lever to remove choke rod from slot in lever.
2. Remove choke rod from lower lever inside the float bowl casting.

(NOTE: Remove rod by holding lower lever outward with small screwdriver and twisting rod counterclockwise.)

3. Remove "T" shaped vacuum hose from front vacuum break unit.
4. Remove secondary metering rods by removing the small screw in the top of the metering rod hanger. Lift upward on metering rod hanger until the secondary metering rods are completely out of the air horn. Metering rods may be disassembled from the hanger by rotating ends out of the holes in the end of the hanger, Fig. 6-78.
5. Using a pin punch or J-25322, drive pump lever pivot roll pin inward until pump lever can be removed from air horn, Fig. 6-79. Then remove pump lever from pump rod.

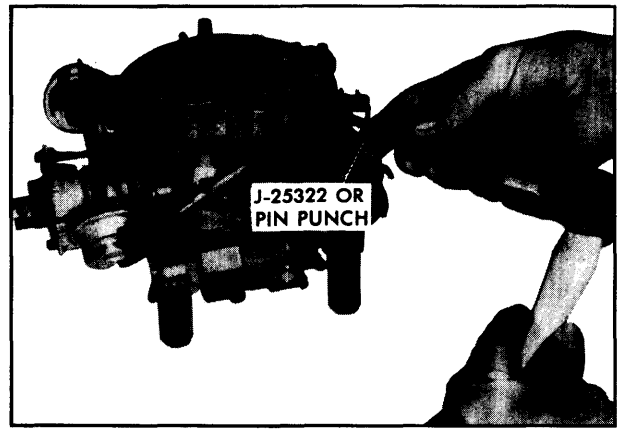


Fig. 6-79 Removing Roll Pin

BACK TO INDEX

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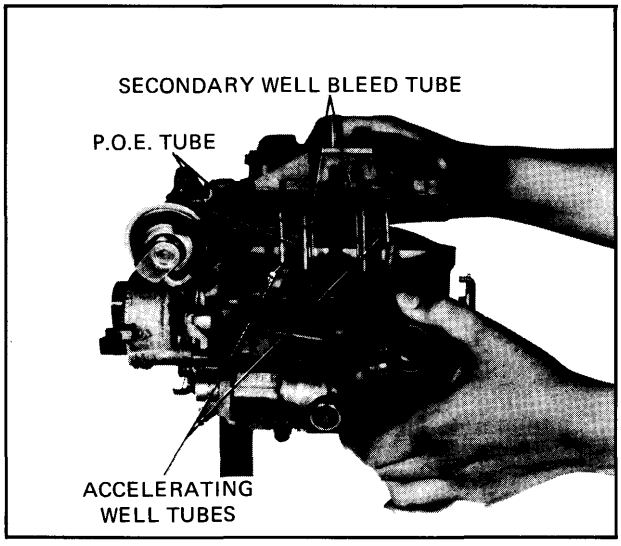


Fig. 6-80 Air Horn Tubes

CAUTION: Do not remove roll pin during removal or disassembly of air horn.

6. Remove nine air horn to bowl attaching screws: two attaching screws are located next to the primary venturi. (Two long screws, five short screws, and two countersunk screws.) Remove cover and gasket from beneath front air horn screw, Fig. 6-80.

7. Remove air horn from float bowl by lifting straight up. The air horn gasket should remain on the float bowl for removal later.

CAUTION: When removing air horn from float bowl, use care to prevent bending the small tubes protruding from the air horn. These tubes are permanently pressed into the air horn casting. DO NOT REMOVE.

b. Air Horn Disassembly

1. If not removed previously, remove front vacuum break bracket attaching screws. The diaphragm assembly may now be removed from the air valve dashpot rod and the dashpot rod from the air valve lever.

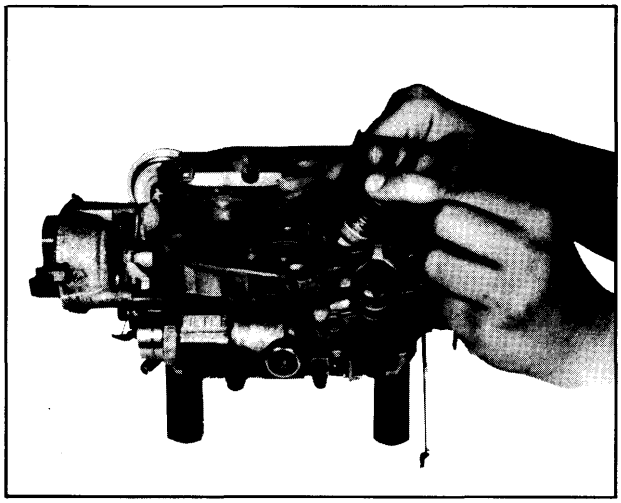


Fig. 6-81 Removing Accelerator Pump

CAUTION: Do not place vacuum break assemblies in carburetor cleaner.

2. Further disassembly of the air horn is not required or recommended for cleaning purposes. If part replacement is required, proceed as follows:

Remove staking on (2) choke valve attaching screws, then remove choke valve and shaft from air horn.

(NOTE: Air valves and air valve shaft should not be removed. However, if it is necessary to replace the air valve closing spring or center plastic eccentric cam, a repair kit is available. Instructions for assembly are included in the repair kit.)

c. Float Bowl Disassembly

1. Carefully loosen air horn gasket and lift one corner. Remove pump plunger from pump well, Fig. 6-81.

2. Remove air horn gasket by lifting tab of gasket from beneath the power piston hanger, being careful not to distort spring holding the main metering rods.

3. Remove pump return spring from pump well.

4. Remove power piston and metering rods by depressing piston stem and allowing it to snap free.

(NOTE: The power piston can be easily removed by pressing the piston down and releasing it with a snap. This will cause the power piston spring to snap the piston up against the retainer. This procedure may have to be repeated several times. DO NOT REMOVE POWER PISTON BY USING PLIERS ON METERING ROD HANGER. Remove the power piston spring from the well.

CAUTION: The A.P.T. metering rod adjustment screw on M4ME models is pre-set at the factory and no attempt should be made to change this adjustment in the field. If float bowl replacement is required during service, the new bowl assembly will be supplied with an adjustment screw which will be pre-set as required.

5. Remove metering rods from power piston by disconnecting tension spring from top of each rod, then rotate rod to remove from hanger.

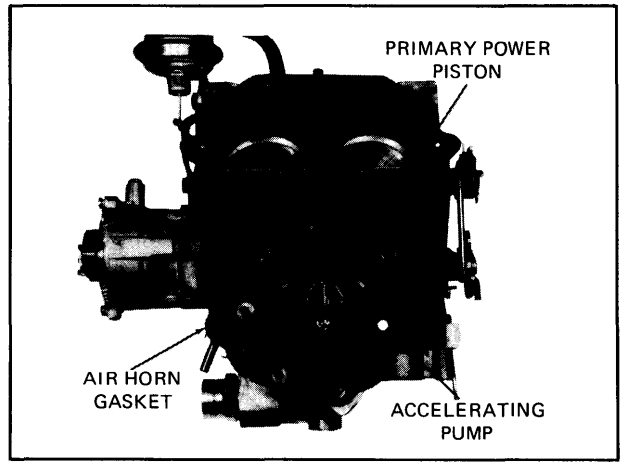


Fig. 6-82 Float Bowl (M4ME)

BACK TO INDEX

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Fig. 6-83 Removing Inlet Valve Seat

CAUTION: Use care when disassembling rods to prevent distortion of tension spring and/or metering rods. Note carefully position of tension spring for later reassembly, Fig. 6-82.

6. Remove plastic filler block over float valve.
7. Remove float assembly and float needle by pulling up on retaining pin. Remove float needle seat and gasket using Seat Remover, J-22769, Fig. 6-83.
8. Remove aneroid cavity insert, if used.
9. On M4MEA models, remove two cover screws and carefully lift the A.P.T. metering rod, with aneroid, from the float bowl (Fig. 6-84).

CAUTION: The A.P.T. metering rod with aneroid, is extremely fragile. Use care in handling. Do not immerse aneroid in carburetor cleaner. The A.P.T. metering rod is pre-set at the factory and NO attempt should be made to re-adjust in the field.

10. Remove primary main metering jets only if necessary.

(NOTE: No attempt should be made to remove the secondary metering plates, or the aneroid jet (M4MEA only) Fig. 6-85. These jets are fixed and, if damaged, float bowl replacement is required.)

11. Remove pump discharge check ball retainer and check ball.
12. Remove baffle from secondary side of bowl.
13. Remove baffle from side of pump well.
14. Remove hose from rear vacuum break control assembly. Remove two screws from rear vacuum break bracket and rotate the assembly to remove vacuum break rod from slot in plunger head.

CAUTION: Do not place vacuum break assemblies in carburetor cleaner.

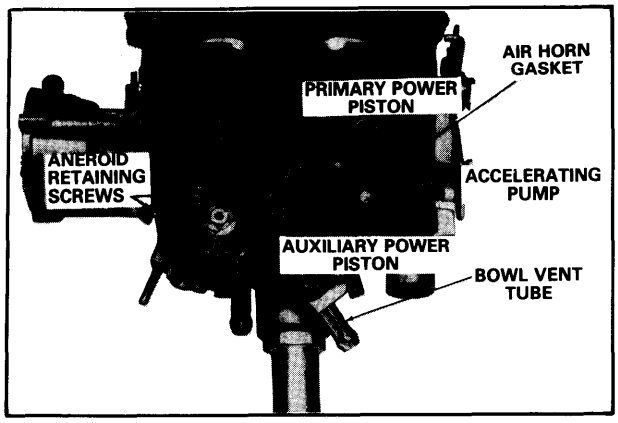


Fig. 6-84 Float Bowl (M4MEA)

15. Remove vacuum break rod by holding down on fast idle cam (hot idle position); move end of vacuum break rod away from float bowl then disengage rod from hole in intermediate choke lever.

d. Choke Disassembly

1. Remove three (3) attaching screws and retainers from electric choke cover and coil assembly. Then pull straight outward and remove electric choke cover and coil assembly from choke housing.
2. Remove choke housing assembly from float bowl by removing retaining screw and washer assembly inside the choke housing. The complete choke assembly can be removed from the float bowl by sliding outward.
3. Remove secondary throttle valve lock-out lever from float bowl.
4. Remove lower choke lever from inside float bowl cavity by inverting bowl.
5. To disassemble intermediate choke shaft from choke housing, remove coil lever retaining screw at end of shaft inside the choke housing. Then remove thermostatic coil lever from flats on intermediate choke

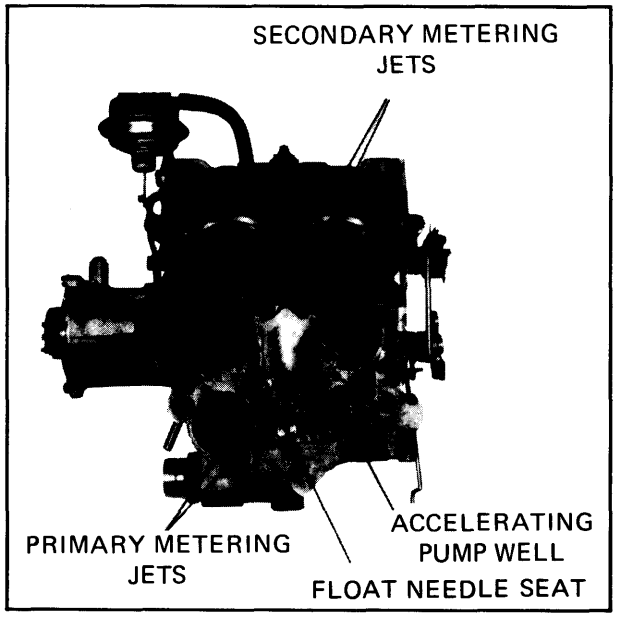


Fig. 6-85 Metering Jets

BACK TO INDEX

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shaft. Remove intermediate choke shaft from the choke housing by sliding outward. The fast idle cam can now be removed from the intermediate choke shaft.

CAUTION: Remove the cup seal from the float bowl for bowl cleaning purposes.

e. Disassembly Of Remaining Float Bowl Parts

1. Remove fuel inlet nut, gasket, filter and spring.
2. Remove throttle body by removing two throttle body to bowl attaching screws.
3. Carefully remove throttle body to bowl insulator gasket.

f. Throttle Body Disassembly

1. Remove pump rod from throttle lever.
2. DO NOT REMOVE idle mixture limiter caps, unless it is necessary to replace the mixture needles or normal soaking and air pressure fails to clean the idle passages. If the idle mixture needles are removed, adjustment procedures will be covered in Note 64.

If necessary to remove the idle mixture needle, destroy plastic limiter cap. Do not install a replacement cap as a bare mixture screw is sufficient to indicate that the mixture has been re-adjusted.

g. Cleaning and Inspection

1. Thoroughly clean carburetor castings and metal parts in an approved cleaner, such as Carbon X(X-55), or its equivalent.

CAUTION: The electric choke, rubber parts, filter and check valve, plastic parts, pump plunger, aneroid, and choke vacuum breaks should not be immersed in carburetor cleaner. However, the throttle valve shafts will withstand normal cleaning in carburetor cleaner.

2. Blow out all passages in castings with compressed air.

CAUTION: Do not pass drills through jets or passages.

3. Examine float needle and seat for wear. Replace, if necessary, with new float needle and seat assembly.
4. Inspect upper and lower surfaces of carburetor castings for damage.
5. Inspect holes in levers for excessive wear or out of round conditions. If worn, levers should be replaced.
6. Examine fast idle cam for wear or damage.
7. Check air valve for binding conditions. If air valve is damaged, air horn assembly must be replaced.
8. Check all throttle levers and valves for binds or other damage.

45. Carburetor Assembly

a. Throttle Body Assembly

1. If removed, install idle mixture needles and springs until seated. Back out the mixture needles four turns as a preliminary idle adjustment. Final adjustment must be made on the engine using the procedures described in Note 64.
2. Install lower end of pump rod in throttle lever by aligning tang on rod with slot in lever. End of rod should point outwards towards throttle lever.

b. Float Bowl Assembly

1. Install new throttle body to bowl gasket over two locating dowels on bowl.
2. Install throttle body, making certain throttle body is properly located over dowels on float bowl, then install two throttle body to bowl screws and tighten evenly and securely.
3. Place carburetor on holding fixture, J-8328-1.
4. If removed, install check valve in fuel inlet filter.

CAUTION: The fuel inlet check valve must be installed in the filter to meet Motor Vehicle Safety Standards (M.V.S.S.) for roll-over. New service replacement filters include the check valve.

5. Install fuel inlet filter spring, filter and check valve assembly, new gasket, and inlet nut and tighten nut to 18 ft.-lbs. Check valve end of filter faces toward fuel line.

CAUTION: Tightening beyond specified torque can damage gasket.

(NOTE: Ribs on closed end of filter element prevent filter from being installed incorrectly unless forced.)

c. Choke Housing Assembly To Float Bowl

1. Install new cup seal into insert on side of float bowl for intermediate choke shaft. Lip on cup seal faces outward.
2. Install secondary throttle valve lock-out lever on boss on float bowl with recess in hole in lever facing carburetor bowl, Fig. 6-86.
3. Install fast idle cam onto the intermediate choke shaft (steps on fast idle cam face downward), Fig. 6-87.
4. Carefully install fast idle cam and intermediate choke shaft assembly in choke housing, Fig. 6-87, then install thermostatic coil lever onto flats on intermediate choke shaft. Inside thermostatic choke coil lever is properly aligned when both inside and outside levers face towards fuel inlet. Install inside lever retaining

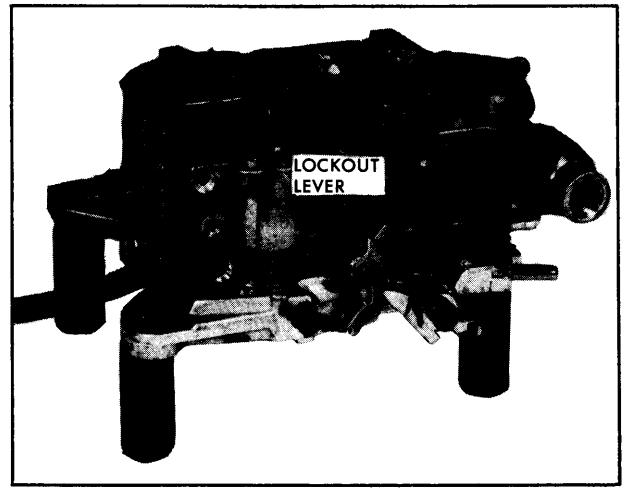


Fig. 6-86 Secondary Lockout Linkage

BACK TO INDEX

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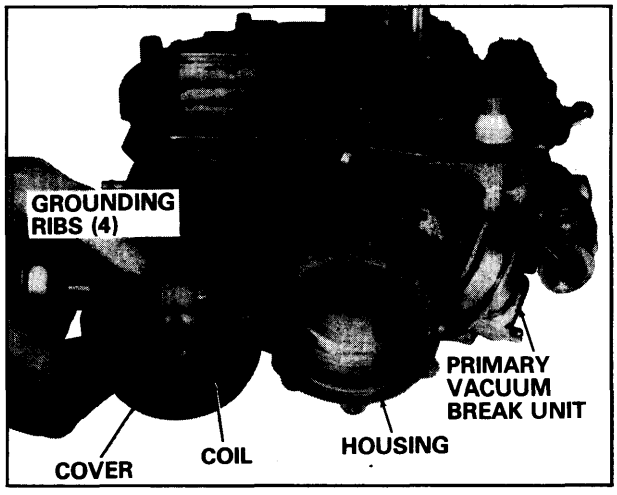


Fig. 6-87 Choke Linkage

screw into end of intermediate choke shaft. Tighten securely.

5. Install lower choke rod lever into cavity in float bowl. Install choke housing to bowl sliding intermediate choke shaft into lower choke lever.

(NOTE: Tool J-23417 can be used to hold the lower choke lever in correct position while installing the choke housing, Fig. 6-88.)

6. Install choke housing retaining screw and washer and tighten securely.

(NOTE: The intermediate choke shaft lever and fast idle cam are in correct relation when the tang on lever is beneath the fast idle cam. Do not install electric choke cover and coil assembly until inside coil lever is adjusted. (See Note 51).

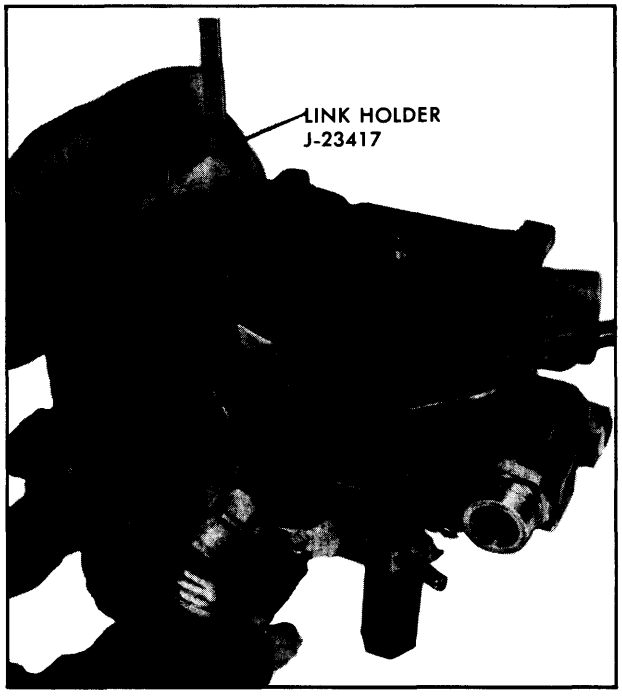


Fig. 6-88 Holding Choke Link

d. Completion Of Float Bowl Assembly

1. Holding down on fast idle cam (hot idle position), install end of rear vacuum break rod in hole in intermediate choke lever.

2. Install end of rear vacuum break rod in slot in rear vacuum break plunger head. Then install rear vacuum break control and bracket assembly to float bowl using two (2) attaching screws. Tighten securely.

(NOTE: Do not attach vacuum break hose until after the vacuum break adjustment is completed (See Note 55).

3. Install air baffle in secondary side of float bowl with notches toward the top. Top edge of baffle at the inserting slots must be flush with bowl casting.

4. Install baffle in side of pump well with slot towards bottom.

5. Install pump discharge check ball and retainer in passage next to pump well. Tighten retainer securely.

6. Install primary main metering jets, Fig. 6-85. (if removed).

7. On M4ME models, install aneroid cavity insert into float bowl.

8. On M4MEA models, carefully install A.P.T. metering rod and cover assembly into float bowl aligning tab on cover assembly with slot in float bowl closest to the fuel inlet nut, Fig. 6-85. Use care installing the A.P.T. metering rod and cover assembly into float bowl to prevent damage to the aneroid or metering rod tip.

9. Install new needle seat assembly, with gasket, using seat installer J-22769, Fig. 6-84.

10. Install needle by sliding float lever under needle pull clip – correct installation of the needle pull clip is to hook the clip over the edge of the float on the float arm facing the float pontoon, Fig. 6-89. With float lever in pull clip, hold float assembly at toe and install retaining pin from aneroid cavity side (ends of retaining pin face the accelerating pump well).

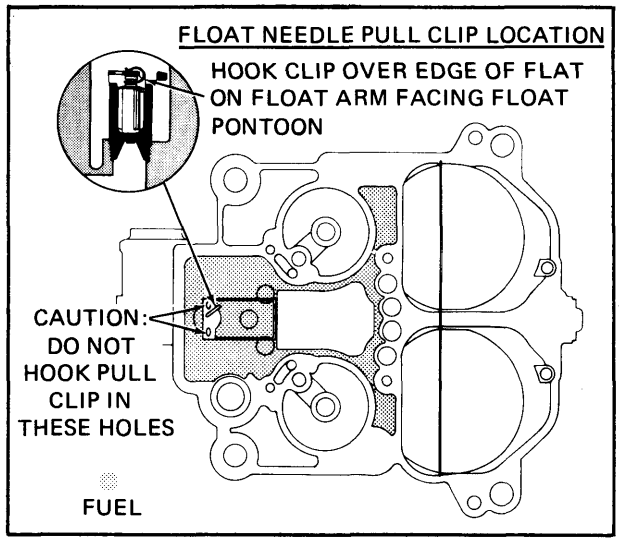


Fig. 6-89 Float Needle Pull Clip Location

BACK TO INDEX

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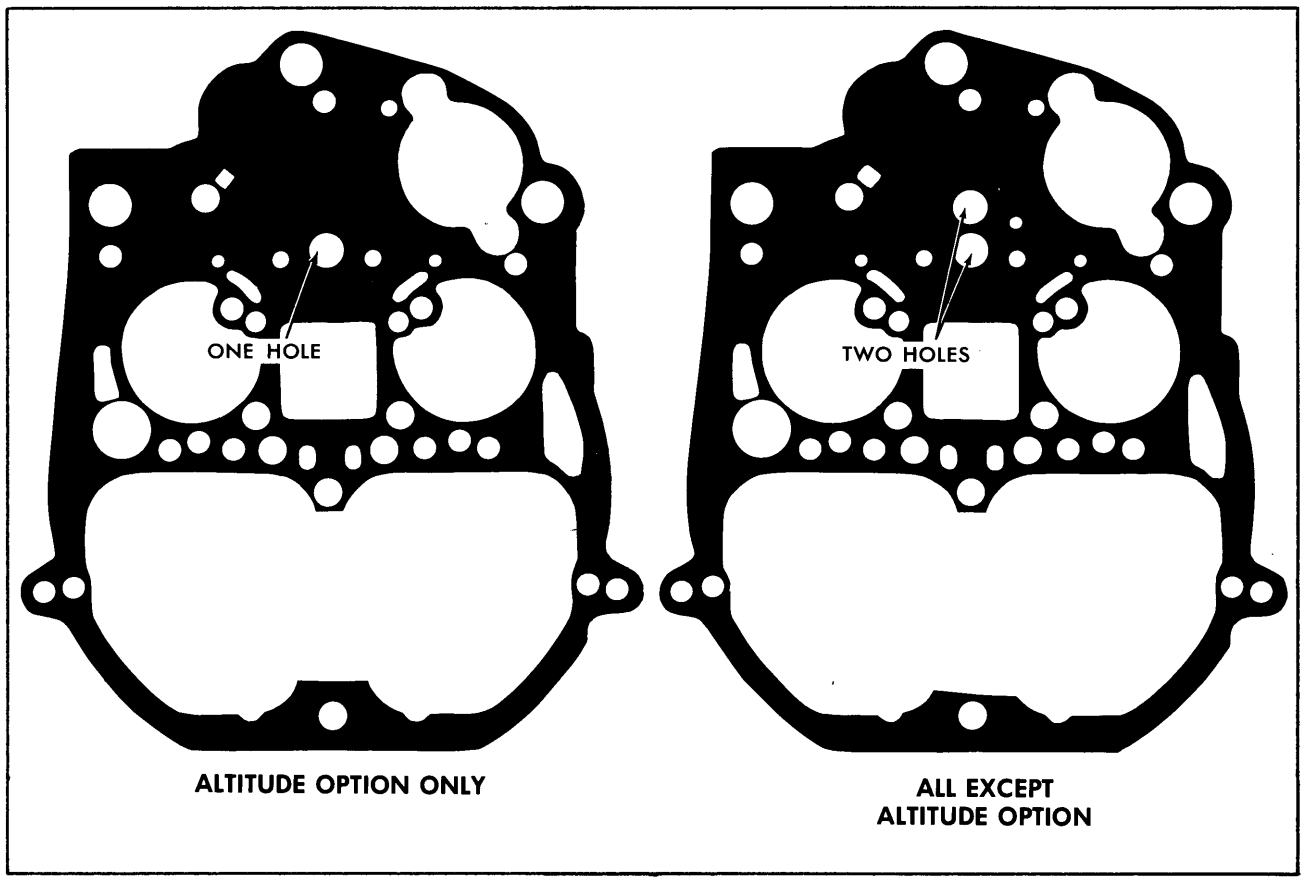


Fig. 6-90 Air Horn Gaskets

CAUTION: Do not install float needle pull clip into holes in float arm.

11. Adjust float level as described in Note 46.

12. Install plastic filler block over float needle, pressing downward until properly seated.

13. Install power piston spring in power piston well.

If main metering rods were removed from hanger, reinstall making sure tension spring is connected to top of each rod, Fig. 6-83. Install power piston assembly in rear well, (aligning pin on piston with slot in well) with metering rods properly positioned in metering jets. Press down firmly on plastic power piston retainer to make sure the retainer is seated in recess in bowl and the top is flush with the top of the bowl casting. If necessary, using a drift punch and small hammer, tap retainer lightly in place.

14. Install baffle into slot inside of pump well. Notch in baffle should be down when installed.

15. Install accelerator pump return spring in pump well.

16. Install air horn gasket by carefully sliding tab of gasket around main metering rods and beneath the power piston hanger. Position gasket over the two dowel pins on the float bowl.

(NOTE: Two different air horn gaskets are used. The two gaskets, Fig. 6-90, differ in that the gasket for the altitude model with aneroid does not have an extra hole forward of the main metering rod hanger for the apt adjustment Fig. 6-90. Be sure to use the correct gasket for the carburetor being repaired.)

17. Carefully lift one corner of the air horn gasket and install pump plunger in the pump well by pushing the plunger to the bottom of the well against return spring tension. While holding in this position, align pump plunger stem with hole in gasket and press gasket in place.

46. Float Level Adjustment (Fig.6-91)

(NOTE: To make adjustment easier, bend float arm upward at notch in arm before assembly.)

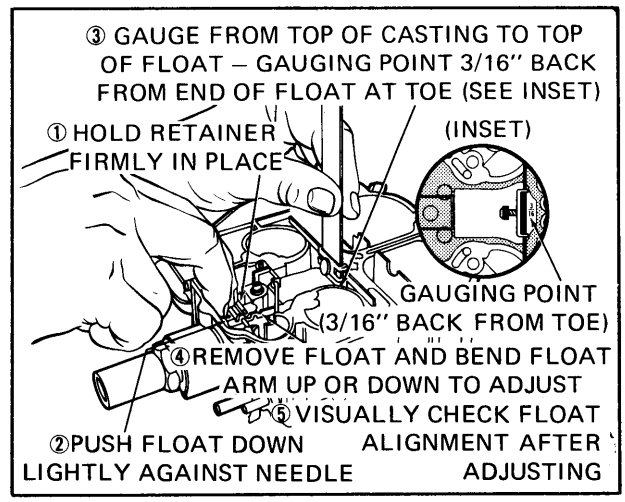


Fig. 6-91 Float Level Adjustment

BACK TO INDEX

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1. Hold float hinge pin firmly in place.
2. Push float down lightly against needle.
3. With adjustable T-scale, gauge from top of float bowl casting (air horn gasket removed) to top of float – gauging point is 3/16" back from end of float at toe. (See inset – Fig. 6-91.)
4. Bend float arm as necessary for proper adjustment.
5. Visually check float alignment after adjustment.

47. Air Horn Assembly

If removed, install choke shaft, choke valve, and two (2) attaching screws. Tighten screws securely and stake lightly in place.

(NOTE: Check choke valve for freedom of movement and proper alignment before staking screws in place.)

48. Air Horn to Bowl Installation

1. Holding down on air horn gasket at pump plunger location, carefully lower air horn assembly onto float bowl making sure that the bleed tubes, accelerating well tubes, pull-over enrichment tubes and pump plunger stem are positioned properly through the holes in the air horn gasket, Fig. 6-80.

SEQUENCE*	DESCRIPTION
1	Countersunk
2	Countersunk
3	Short
4	Short
5	Short
6	Long
7	Long
8	Short
9	Short

*See Fig. 6-93.

Fig. 6-92 Air Horn Screws Position

CAUTION: Do not force the air horn assembly onto the bowl but rather lightly lower in place.

2. Referring to Fig. 6-92 and Fig. 6-93 install nine air horn screws. The gasket and cover are retained with screw No. 5. Tighten evenly and securly, using the sequence in Fig. 6-93.

3. Install front vacuum break diaphragm rod into the slot in lever on the end of the air valve shaft. Then install the other end of rod into hole in the front vacuum break diaphragm plunger. Install front vacuum break control and bracket assembly to air horn using two retaining screws through the bracket. Tighten screws securely.

(NOTE: Do not attach vacuum break ("T") hose until vacuum break adjustment is completed. See Note 54).

4. Connect upper end of pump rod to pump lever by placing rod in outer hole in lever. On California Model #17056530, rod is in inner hole. Using Tool J-25322, align hole in pump lever with hole in air horn casting. Using small screwdriver, push pump lever roll pin back through casting until end of pin is flush with casting bosses in air horn.

CAUTION: Use care installing the small roll pin to prevent damage to pump lever casting bosses.

5. Install two secondary metering rods into the secondary metering rod hanger (upper end of rods point toward each other). Install secondary metering rod holder, with rods, onto air valve cam follower. Install retaining screw and tighten securely, Fig. 6-78. Work air valves up and down several times to make sure they are free in all positions.
6. Connect choke rod into lower choke lever inside bowl cavity. The end of the rod must point outward (toward choke housing) when properly installed; then install choke rod into slot in upper choke lever and retain the choke lever to the end of the choke shaft with attaching screw. When properly installed the lever will point to the rear of the carburetor and the number on the lever will face outward. Fig. 6-78. Tighten securely.

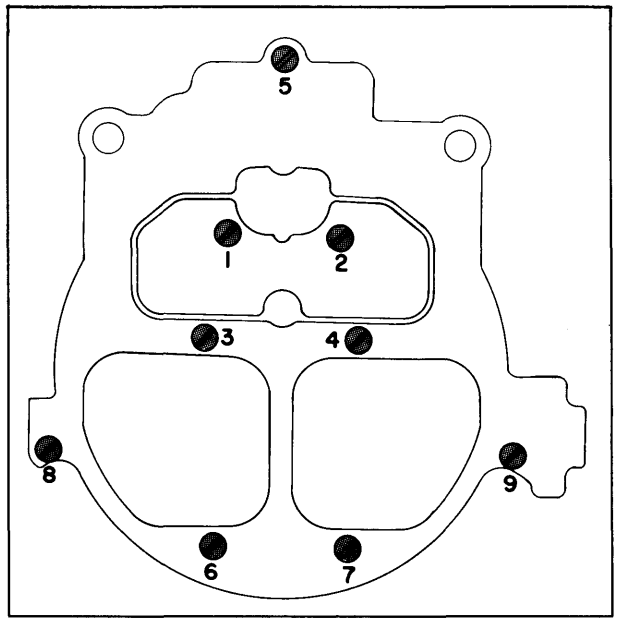


Fig. 6-93 Air Horn Screws Tightening Sequence

BACK TO INDEX

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(NOTE: The front and rear vacuum break units, fast idle cam (choke rod), and inside thermostatic choke coil lever must be adjusted properly before installing the electric choke thermostatic coil and cover assembly. Refer to Notes 54, 55, 52 and 51 respectively for adjustment information.)

7. After the vacuum break, fast idle cam (choke rod), and inside thermostatic coil lever are adjusted, the electric thermostatic coil and cover assembly should be installed and the cover assembly rotated counterclockwise until the choke valve closes. Rotate cover so that the scribe mark on the cover lines up with the two notch rich pointer on the choke housing. (See Automatic Choke Coil Adjustment, Note 56.)

CAUTION: Do not install a choke cover gasket between the electric choke assembly and the choke housing.

Install three choke cover retainers and screws and tighten securely.

8. After making vacuum break settings connect the rear vacuum break hose and the front vacuum break vacuum tee. Be careful to push the tee on fully so that no kinks are present. A kinked vacuum tee may cause restricted signal to the vacuum advance mechanism causing detonation.

ADJUSTMENT PROCEDURES

The following adjustments must be performed in proper sequence to ensure proper carburetor function.

49. Pump Rod Adjustment (Fig. 6-94)

1. With fast idle cam follower off steps of fast idle cam, back out idle speed screw until the throttle valves are completely closed in bore.

(NOTE: Be sure secondary actuating rod is not keeping the primary throttle valves from closing. If the primary throttle valves do not completely close, bend the secondary closing tang out of position and then readjust after pump adjustment.)

2. Place pump rod in outer hole in lever (inner hole for California Models).

3. Gauge from top of choke valve wall, next to vent stack, to top of pump stem. Dimension should be 3/8 inch.

4. Bend pump lever, as shown in Fig. 6-94, to adjust (see inset).

(NOTE: Support pump lever with screwdriver while bending lever.)

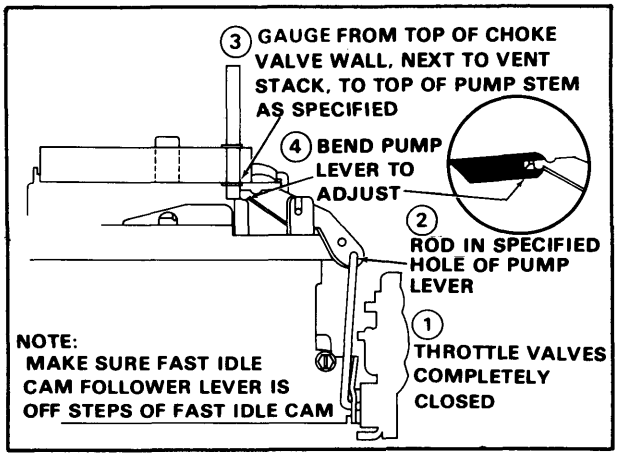


Fig. 6-94 Pump Rod Adjustment

50. Fast Idle Adjustment (Fig. 6-95)

1. Place fast idle cam follower on top step of the fast idle cam and hold the follower against the cam.

2. While holding the follower against the high step of the fast idle cam, back out the fast idle screw (counterclockwise) until it pulls away from the fast idle cam follower. Turn in fast idle screw (clockwise), until the screw just contacts the fast idle cam follower.

3. Then turn the fast idle screw in an additional two turns on Federal cars, 2-1/4 turns on California cars (see page 6-84 for definition of California cars).

(NOTE: Recheck fast idle speed on the car setting to specifications listed on underhood tune-up label.)

51. Choke Coil Lever Adjustment (Fig. 6-96)

1. Loosen three retaining screws and remove electric thermostatic cover and coil assembly from choke housing.

2. Push up on thermostatic coil tang (counterclockwise) until choke valve is closed. Throttle

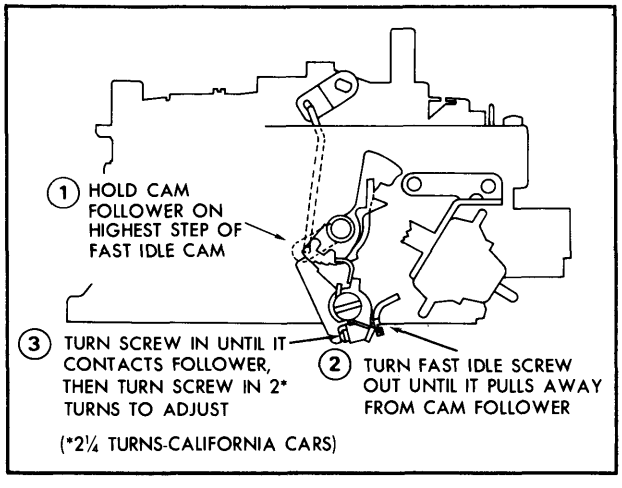


Fig. 6-95 Fast Idle Adjustment

BACK TO INDEX

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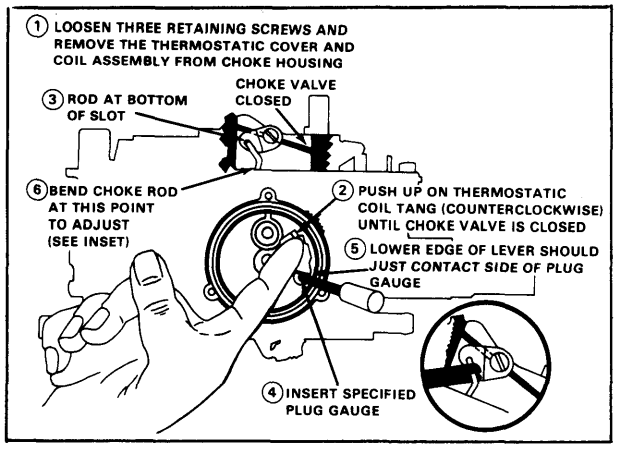


Fig. 6-96 Choke Coil Lever Adjustment

may have to be opened partially to permit fast idle cam follower to rest on top step of fast idle cam.

3. Insert .120" plug gauge in hole in choke housing, Fig. 6-96.

4. Lower edge of choke coil lever should just contact side of plug gauge.

5. Bend choke rod at point shown to adjust (see inset), Fig. 6-96.

52. Fast Idle Cam (Choke Rod) Adjustment (Fig. 6-97)

1. Choke coil lever adjustment must be made before making the following adjustment.

2. Remove coil assembly from choke housing by removing the three retaining screws and clips.

3. Perform fast idle adjustment as described in Note 50.

4. Place the fast idle cam follower on the second step of the fast idle cam firmly against the shoulder of the high step.

5. Close the choke valve by pushing upward on the choke coil lever inside the choke housing.

6. Gauge between the upper edge of the choke valve and inside air horn vertical wall. Gauge dimension should be 0.080".

7. Bend adjusting tang on fast idle cam to obtain

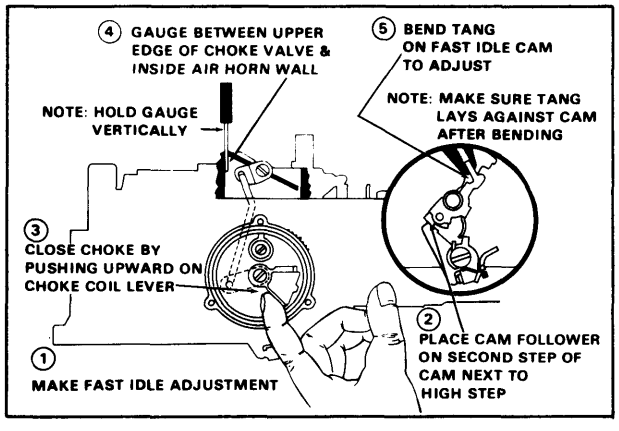


Fig. 6-97 Choke Rod Adjustment

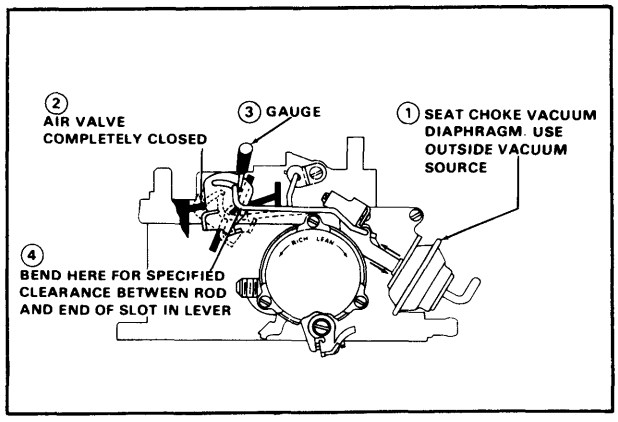


Fig. 6-98 Air Valve Dash Pot Adjustment

the 0.080" dimension. Make sure tang lays against cam after bending.

8. Re-install coil assembly into choke housing. Be sure that the coil tang picks up the choke coil lever and closes the choke valve when rotating the coil cover counterclockwise.

9. Install the screws and retainers after indexing the coil two notches richer (to the left) than index mark. Secure the cover to the housing at the proper index by tightening the three screws.

(NOTE: Always check fast idle adjustment on car by setting engine speed to specification listed on underhood tune-up label.)

53. Air Valve Dashpot Adjustment (Fig. 6-98)

1. Seat front vacuum break diaphragm using outside vacuum source.

2. Air valves must be closed completely.

3. Place .030" gauge between air valve dashpot rod and end of slot in air valve lever.

4. Bend air valve dashpot rod at point shown if necessary to adjust.

54. Front Vacuum Break Adjustment (Fig. 6-99)

1. Loosen three retaining screws and remove electric thermostatic cover and coil assembly from choke housing.

2. Place cam follower lever on highest step of fast idle cam.

3. Seat the front vacuum diaphragm using an outside vacuum source.

4. Push up on inside choke coil lever until tang on vacuum break lever contacts tang on vacuum break plunger.

5. Remove slack from linkage by pressing down on lower edge of choke valve.

6. Place gauge between upper edge of choke valve and inside air horn wall. Dimension should be .160".

7. To obtain correct specification, turn the adjustment screw on the vacuum break plunger lever.

BACK TO INDEX

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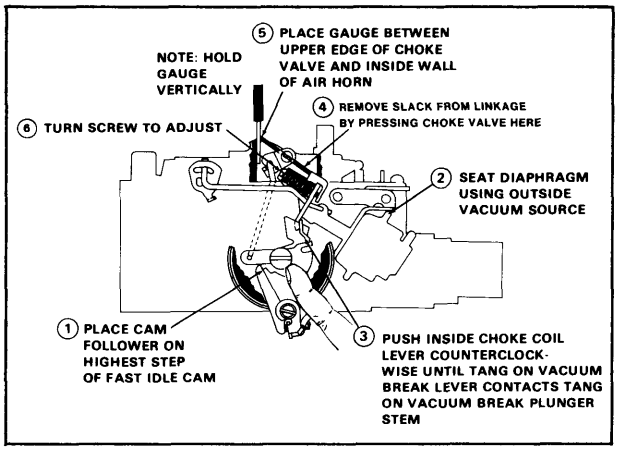


Fig. 6-99 Front Vacuum Break Adjustment

8. After adjustment, install vacuum tee to vacuum break unit. Be careful to push the tee on fully so that no kinks are present. A kinked tee may cause restricted vacuum signal to the distributor, resulting in detonation.

55. Rear Vacuum Break Adjustment (Fig. 6-100)

1. Loosen three retaining screws and remove electric thermostatic cover and coil assembly from choke housing.

2. Place cam follower lever on highest step of fast idle cam.

3. Plug the bleed hole and the entire end cover of the vacuum break unit using a piece of tape approximately one inch square.

4. Seat the rear vacuum diaphragm using an outside vacuum source.

(NOTE: With the delay feature, it will take a few seconds for the diaphragm to seat).

5. Push up on choke coil lever inside choke housing toward closed choke until stem is pulled out and seated-(spring compressed).

6. Remove slack from linkage by pressing down on lower edge of choke valve.

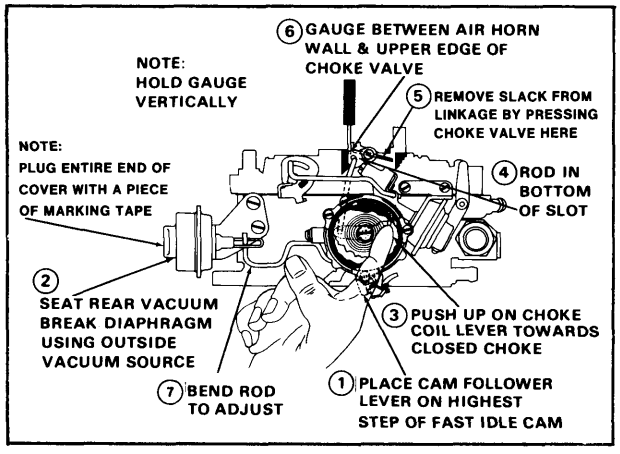


Fig. 6-100 Rear Vacuum Break Adjustment

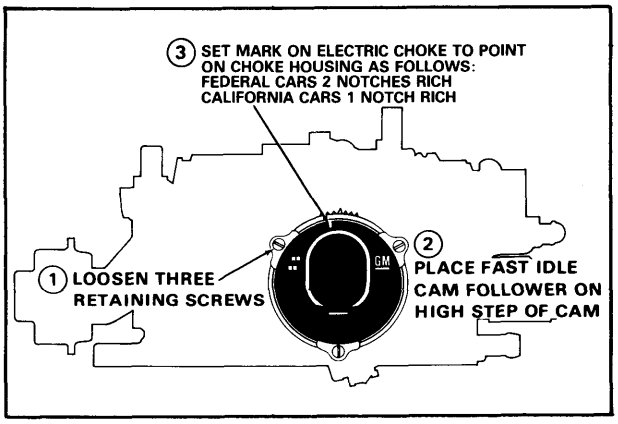


Fig. 6-101 Choke Index Adjustment

7. With choke rod in bottom of slot in choke lever, gauge between upper edge of choke valve and air horn wall. Dimension should be .160".

8. Bend vacuum break rod at point shown if necessary to adjust.

9. After adjustment, remove tape from end cover of vacuum break unit. Install carburetor vacuum hose to vacuum break unit.

56. Automatic Choke Coil Adjustment (Fig. 6-101)

1. Install the electric choke assembly in choke housing, making sure coil tang contacts bottom side of inside choke coil lever pick-up arm.

2. Place fast idle cam follower on high step of cam.

3. Align index point on cover two notches rich (2 marks left of index mark on housing.)

4. Install cover retainers and screws and tighten securely.

(NOTE: Ground contact for the electric choke is provided by a metal plate located at the rear of the choke assembly. DO NOT INSTALL A CHOKE COVER GASKET BETWEEN THE ELECTRIC CHOKE ASSEMBLY AND THE CHOKE HOUSING).

CAUTION: Do not immerse the electric choke assembly in any cleaning solution or severe damage can result.

57. Unloader Adjustment (Fig. 6-102)

1. Install electric choke thermostatic coil and cover assembly in choke housing and aligh index mark on cover as described in Note 56.

2. With choke valve completely closed, hold throttle valves wide open.

(NOTE: On warm engine, close choke valve by pushing up on tang of intermediate choke lever that contacts fast idle cam. A rubber band may be used for this purpose).

3. Gauge between upper edge of choke valve and air horn wall. Dimension should be .215".

BACK TO INDEX

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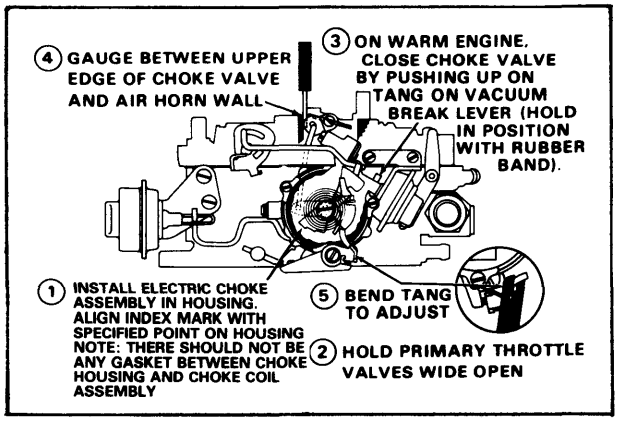


Fig. 6-102 Unloader Adjustment

4. Bend tang on fast idle lever as shown to adjust.

CAUTION: Check to be sure unloader tang on fast idle lever is contacting center point of fast idle cam unloader tang after adjustment.

58. Secondary Lock-out Lever Clearance (Fig. 6-103)

1. Hold choke valve and secondary throttle valves closed.
2. Using .015" plug gauge, measure clearance between lock-out pin and lock-out lever as shown.
3. If necessary, bend lock-out pin at point shown to obtain specified clearance.

59. Secondary Throttle Valve Lock-out Opening Adjustment (Fig. 6-103)

1. Hold choke valve wide open by pushing down on tail of fast idle cam and holding it down.

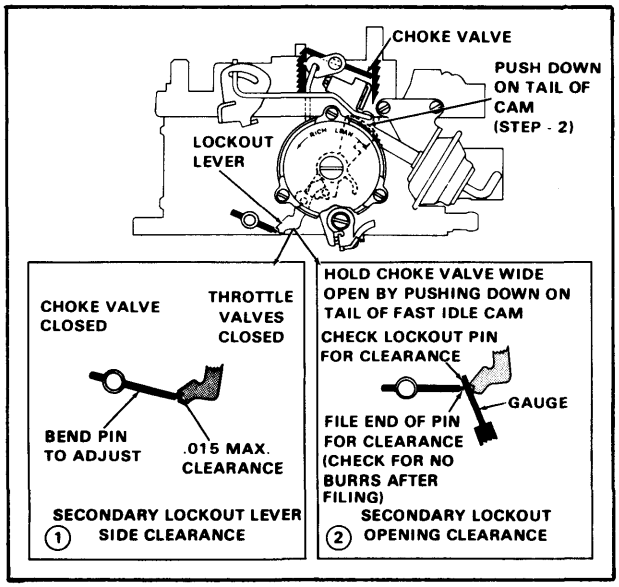


Fig. 6-103 Secondary Lockout Adjustments

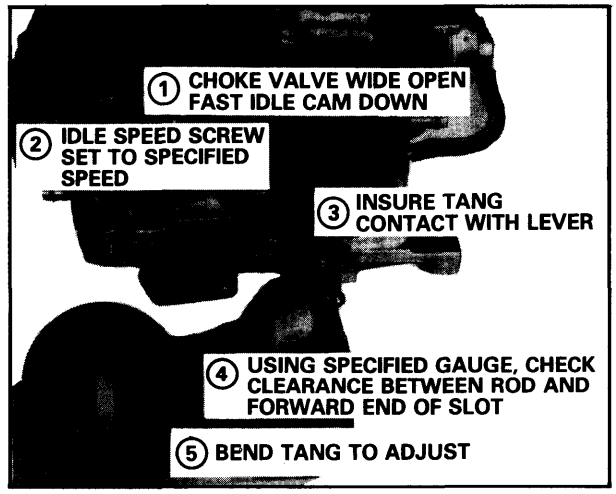


Fig. 6-104 Secondary Closing Adjustment

2. Push the lockout lever counterclockwise so that upper end of lever is in contact with round pin in fast idle cam.
3. Hold secondary throttle valves slightly open.
4. Using .015" plug gauge, measure clearance between end of lock-out pin and toe of lock-out lever as shown.
5. If necessary, file off end of lock-out pin to obtain specified clearance.

60. Secondary Closing Adjustment (Fig. 6-104)

1. With choke valve wide open, fast idle cam down, and fast idle cam follower off the fast idle cam, seat the primary throttle valves in the bores by backing off the idle adjusting screw.
2. Turn in the idle adjusting screw until it makes contact with the idle stop tab on the primary throttle lever.
3. Turn screw in (clockwise) one more turn.
4. There should be a 0.020" clearance between actuating rod and front of slot in secondary throttle lever Fig. 6-104 when primary throttle middle lever is against secondary closing tang on primary throttle outer lever.
5. Bend secondary closing tang on primary lever as shown to adjust.

(NOTE: After adjustment, readjust curb idle speed on car using idle speed screw. See underhood tune-up label for procedures and specifications.)

61. Secondary Opening Adjustment (Fig. 6-105)

1. Lightly open primary throttle lever until link just contacts tang on secondary lever.
2. With link against tang, the link should be in center of slot in secondary lever.
3. Bend tang on secondary lever, as shown, if necessary to adjust.

BACK TO INDEX

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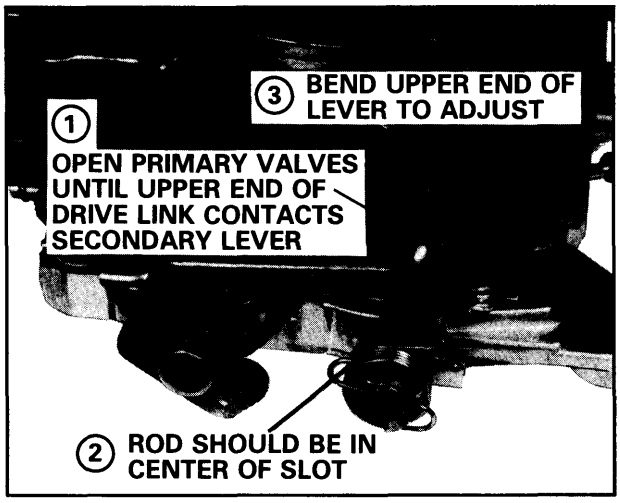


Fig. 6-105 Secondary Opening Adjustment

62. Air Valve Spring Wind-Up Adjustment (Fig. 6-106)

1. Remove front vacuum break diaphragm unit and air valve dashpot rod (see Note 44b, for disassembly procedures).
2. Loosen lock screw using hex wrench.
3. Turn tension adjusting screw counterclockwise until air valve opens part way.
4. Turn tension adjusting screw counterclockwise while tapping lightly on casting with handle of a screwdriver.
5. When air valve just closes, turn tension adjusting screw clockwise an additional 3/8 turn.
6. Tighten lockscrew and replace air valve dashpot rod and front vacuum break diaphragm unit and bracket.

(NOTE: Be sure pin in contact with spring is greased so spring can slide freely).

63. Electric Choke Diagnosis and Checking Procedure

In order to assure good cold driveability and emission control, the electric choke must function properly.

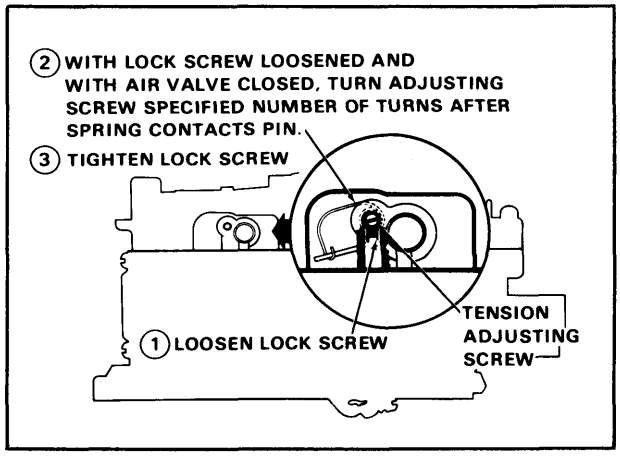


Fig. 6-106 Air Valve Wind-Up Adjustment

Possible reasons for the choke not operating properly are listed below.

1. No engine oil pressure.
2. Malfunctioning oil pressure switch.
3. No current to oil pressure switch due to:
   a. Burned out 25 amp "backup–Trans" fuse.
   b. Broken wire to switch (18 orange, 18 orange/black or 18 dark green).
4. No current between choke coil and oil pressure switch due to:
   a. Broken 18 tan lead wire.
   b. Wire terminal not locked on coil terminal.
   c. Ground circuit incomplete between grounding plate of choke assembly and housing.
5. Failed choke coil assembly.

A voltmeter or continuity light may be used to check the circuits for continuity to the oil pressure switch and the choke coil.

If it is suspected that the choke coil assembly has failed, the following check may be made.

1. Remove coil from carburetor and cool to room temperature (above 60°F).
2. Attach a jumper wire between positive battery terminal and terminal of coil assembly. Attach a second jumper wire between negative battery terminal and grounding plate of choke coil assembly.
3. The tang of the coil should rotate 45° in 54 to 90 seconds.
4. If coil fails to rotate or exceeds the above timing specification, replace coil assembly.
5. If coil is within above timing specification then coil is good and problem is elsewhere.
6. Reinstall coil and set to proper index as described in Note 56.

If coil is cooled off sufficiently the choke valve will close when throttle is opened slightly. Attach a jumper wire between the positive battery terminal and choke coil terminal. Choke coil should warm up and the choke blade can be observed opening, indicating a good and properly grounded choke coil assembly. At room temperature the choke blade should be wide open in approximately 90 seconds.

If the choke does not operate properly after the coil has been proven satisfactory, check out the other possibilities that prevent current from getting to the choke coil.

64. Idle Mixture & Speed Adjustments (On-Car) (Except E.F.I.)

a. Mixture Adjustment

The following procedure should not be considered part of a normal tune up. This procedure only applies in event of a major overhaul of the carburetor or when the throttle body has been replaced.

The idle mixture screws are locked in place with limiter caps which must be removed before a mixture adjustment can be made. When removing the limiter caps be careful not to damage or bend the mixture screws.

The idle mixture adjustment is made as follows:

1. Disconnect parking brake vacuum hose at

BACK TO INDEX

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vacuum release cylinder and plug hose. Disconnect air leveling compressor hose at air cleaner and plug hose. Remove air cleaner but keep vacuum hoses connected.

(NOTE: Hoses must be disconnected at these locations to include any calibrated leakage in balance of system).

2. Connect tachometer to engine, set parking brake securely and block wheels. Place transmission selector lever in Neutral.
3. Mixture screws should be out 5 turns from seated position. Start and warm engine to normal operating temperature. Be sure that choke is full open and that throttle lever stop tang is contacting the carburetor idle speed screw (slow idle position).
4. Place transmission selector lever in either "DR" position and turn A/C off.
5. Set idle speed to 650 rpm on Federal cars and 620 rpm on California cars by adjusting the idle speed screw located at the throttle lever side of the carburetor.

(NOTE: Do not depress the service brake when making engine idle speed adjustments. On cars equipped with "Hydro-boost" brake system the engine speed will be decreased by the application of the brakes.

6. Using Extension Hex-Head Driver, J-22646 turn alternately each mixture screw inward 1/4 turn at a time until the 600 rpm speed is reached.
7. Idle mixture and speed adjustment is now complete. Idle speed should be 600 rpm.
8. Shut off engine and remove tachometer.
9. Connect parking brake vacuum line.
10. Connect distributor and ALC vacuum lines.
11. Install air cleaner.

b. Idle Speed Adjustment

Normal engine idle speed is adjusted with the idle speed screw located at the throttle lever side of carburetor.

If the carburetor has been overhauled, the idle mixture adjustment must be correct before the idle speed adjustment can be made. Basic engine timing at idle should be set to 6° BTDC.

Speed adjustment is made as follows:

1. Disconnect parking brake hose at vacuum release cylinder and plug hose. Set parking brake and block wheels. Disconnect air leveling compressor hose at air cleaner and plug hose.
2. Connect tachometer, start and warm-up engine to operating temperature in park. Choke should be fully open and cam follower lever completely off steps of fast idle cam.
3. Place transmission selector lever in drive, turn air conditioning off.
4. Adjust idle screw on carburetor to give 600 rpm.

(NOTE: Do not depress the service brake when making engine idle speed adjustments. On cars equipped with "Hydro-boost" brake system the engine speed will be decreased by the application of the brakes.

5. Shut off engine. Remove tachometer.
6. Reconnect all disconnected hoses.

65. Throttle Cable Adjustment (Except Eldorado)

1. Remove air cleaner
2. Check linkage for free movement in all positions, and check to see that return spring fully closes the throttle.
3. Remove retainer that holds end of throttle cable in relay lever, and remove from relay lever.
4. On cars equipped with Cruise Control, detach Cruise Control clip at throttle lever and remove chain from throttle pivot.
5. While a helper presses accelerator pedal against floor mat, hold carburetor throttle lever in full throttle (wide open) position. Make sure choke valve is wide open.
6. Turn throttle cable end in either direction as necessary to allow free entry into relay lever, Fig. 6-107.
7. With accelerator pedal released, reinstall retainer on throttle pin on relay lever.
8. Recheck for fully closed throttle. With accelerator pedal pressed again to floor mat, recheck throttle for wide open position.
9. On cars equipped with Cruise Control, install Cruise Control linkage and secure with clip.

66. Throttle Cable Adjustment (Eldorado)

1. Remove air cleaner.
2. Check cable linkage for free movement in all positions, and check to see that return spring fully closes throttle.
3. Disconnect cable retaining clip at throttle adapter plate and remove cable from adapter plate.
4. While a helper presses accelerator pedal against floor mat, hold carburetor throttle lever in full throttle (wide open) position. Make sure choke valve is wide open.



Fig. 6-107 Throttle Cable Adjustment (Except Eldorado)

BACK TO INDEX

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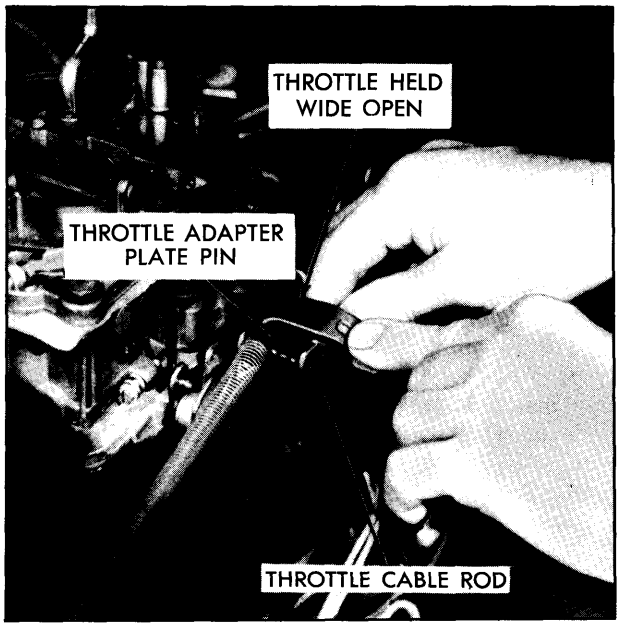


Fig. 6-108 Throttle Cable Adjustment (Eldorado)

5. If cable fitting does not line up exactly with its connecting pin on throttle adapter plate, loosen two nuts at cable mounting plate on left rear of carburetor, and position cable backward or forward to allow exact alignment into throttle adapter plate hole, Fig. 6-108.

6. Tighten cable mounting screws on mounting plate.

7. With accelerator again pressed to floor mat, recheck throttle for wide open position. Recheck for full closed throttle.

8. Replace air cleaner.

67. Fuel Pump Tests

1. To check fuel pump capacity, raise car and disconnect fuel inlet hose at the pump and plug. On cars with A/C clamp off vapor return line; do not remove from pump (Use towel to absorb slight gas drainage.)

2. Connect about 2 feet of flexible gasoline hose (3/8 I.D.) to the fuel pump inlet nipple.

3. Lower car and insert end of flexible hose into gallon container with 1/2 gallon of kerosene, wash gas or similar solvent (not gasoline). Rest container on floor below the fuel pump. Be sure end of hose does not rest against bottom of container.

4. Disconnect fuel line at carburetor and slip about two feet of flexible gasoline hose (3/8 I.D.) over the flared end of the pipe.

5. Disconnect HEI so that the engine will not start when cranked.

6. Crank engine to prime pump until approximately 1/2 pint of liquid has been pumped and all gasoline purged from the pump before checking output.

7. Seventeen strokes should fill a pint container. If liquid is delivered as specified, pump delivery is normal. If pump delivery is below normal, check for the following possible conditions:

a. Liquid leaking out of pump at fittings or joints. This should be obvious if gasoline has leaked, by the absence of paint on the pump or a clean spot on the engine or frame.

b. Worn eccentric or arm. Remove pump as described in Note 68a and visually check fuel pump eccentric for wear using mirror and flashlight through mounting flange, inspect fuel pump arm for wear. A worn arm generally indicates a worn eccentric.

CAUTION: If fuel pump check shows delivery is adequate but car did not perform satisfactorily, check for pinched, damaged, or leaky fuel inlet line and hoses back to the tank and discharge line to carburetor and the vapor return line, Check for a plugged filter in the gas tank. Replace damaged or inoperative parts.

8. If pump does not operate properly after these checks have been made, replace pump.

9. When installing pump, crank engine until fuel pump eccentric is at its low point of contact with the fuel pump arm. With mounting screws loose, lift up on pump. Tighten screws to 13 foot-pounds.

10. To check pump discharge pressure, remove hose from carburetor end of fuel line and connect pressure gauge using suitable fittings. At cranking speed, fuel pump pressure should be a minimum of 5 pounds per square inch.

If pump pressure is out-of-specification, replace pump.

11. Remove pressure gauge and connect rubber hose previously used. Remove hose from checking solution and crank engine over, collecting discharged liquid in suitable container until all liquid is pumped out of system.

12. Remove hose from carburetor end of fuel line and reconnect fuel line to carburetor securely using tubing wrench. Be sure carburetor inlet nut is tight. Be careful not to disconnect any vacuum hoses or tees at the carburetor.

13. Connect HEI.

14. Raise car and remove rubber hose from inlet side of pump and re-connect flexible hose attached to fuel line.

15. Unclamp vapor return line.

16. Lower car, start engine and check for fuel leaks.

68. Fuel Pump

a. Removal

1. Raise car.

2. Disconnect fuel line from tank (fuel pump inlet) at fuel pump and plug line. Hold a cloth around pump connections to absorb any fuel that leaks out.

3. Remove vapor return hose from fitting on fuel pump and plug hose.

4. Disconnect fuel-pump-to-carburetor line (fuel pump outlet) and position out of way.

5. Remove mounting screws from upper and lower flanges.

BACK TO INDEX

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6. Tipping pump upward, pull pump straight outward and remove from car.

b. Installation

1. Clean mounting flange and place a new gasket in position. Use cement to hold gasket in position.
2. Crank engine until fuel pump eccentric is at low point of contact with fuel pump arm.
3. Position pump on engine. Loosely install two washer head screws.
4. With mounting screws loose, lift up on pump. Tighten screws to 13 foot-pounds.
5. Connect fuel line from carburetor to outlet fitting on pump and tighten securely.
6. Unplug fuel line from fuel tank, attach line to pump inlet and secure with clamp.
7. Install vapor return hose on fitting in fuel pump and secure with clamp.
8. Lower car and run engine to check for leaks in the pump area.

QUADRAJET CARBURETOR SPECIFICATIONS AND ADJUSTMENTS MODEL M4ME AND M4MEA

Throttle Bore Diameter	
Primary	1.375"
Secondary	2.250"
Main Venturi Diameter	
Primary	1.218"
Secondary	.625"
Teritiary	.281"

ADJUSTMENT SPECIFICATIONS

	Altitude Option	Federal Vehicles*	California Vehicles**
Air Valve			
Dashpot	.030"	.030"	.030"
WindUp	3/8 Turn	3/8 Turn	3/8 Turn
Choke Coil Lever	.120"	.120"	.120"
Choke Rod Cam	.080"	.080"	.080"
Choke Setting	2 Notches Rich	2 Notches Rich	2 Notches Rich
Curb Idle-RPM (In Drive, A/C Off)	600	600	600
Fast Idle-RPM (In Park) (A/C Off)			
Second of Three Steps	1400	1400	1400
Float Level	13/32"	13/32"	7/16"
Pump Rod			
Adjustment	3/8"	3/8"	9/32"
Location	Outer Hole	Outer Hole	Inner Hole
Secondary Closing	.020"	.020"	.020"
Secondary Lockout			
Lever Clearance	.015"	.015"	.015"
Opening	.015"	.015"	.015"
Unloader	.230"	.230"	.230"
Vacuum Break			
Front	.160"	.160"	.160"
Rear	.160"	.160"	.160"

*All Vehicles not equipped for sale in the State of California are called Federal Vehicles.
**California Vehicles are defined as all vehicles sold in the State of California AND ALL commercial chassis' equipped with the optional 145 amp generator.

BACK TO INDEX

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1976 CARBURETOR APPLICATION CHART

CARBURETOR NUMBER	APPLICATION	SERIES
7056230 or Equivalent	Federal* Vehicles	All Series
7056530 or Equivalent	California** Vehicles	All Series
7056232 or Equivalent	Federal* Vehicles	All Series With Altitude Option

*All vehicles not equipped for sale in the State of California, are called "Federal Vehicles."
**California vehicles are defined as all vehicles sold in the State of California AND ALL commercial chassis' equipped with the optional 145 amp generator.

FUEL PUMP SPECIFICATIONS

NOTE: Testing to be done with entire car at room temperature.

Fuel pressure at idle speed ..... 5-1/4 to 6-1/2 psi
Fuel pump discharge per stroke at cranking speed ..... 28 cc. Minimum
Fuel pump discharge in 17 strokes at cranking speed ..... 1 pint Minimum

TORQUE SPECIFICATIONS

Material Number	Application	Thread Size	Torque
260-M	Carburetor to Intake Manifold Screw (Rear)	5/16-18	12 ft. lbs.
260-M	Carburetor to Intake Manifold Screw (Front)	5/16-18	8 ft. lbs.
280-M	Fuel Pump to Cylinder Block Screw	5/16-18	13 ft. lbs.

NOTE: Refer to back of manual, Page 16-1, for bolt and nut markings and steel classifications.

BACK TO INDEX

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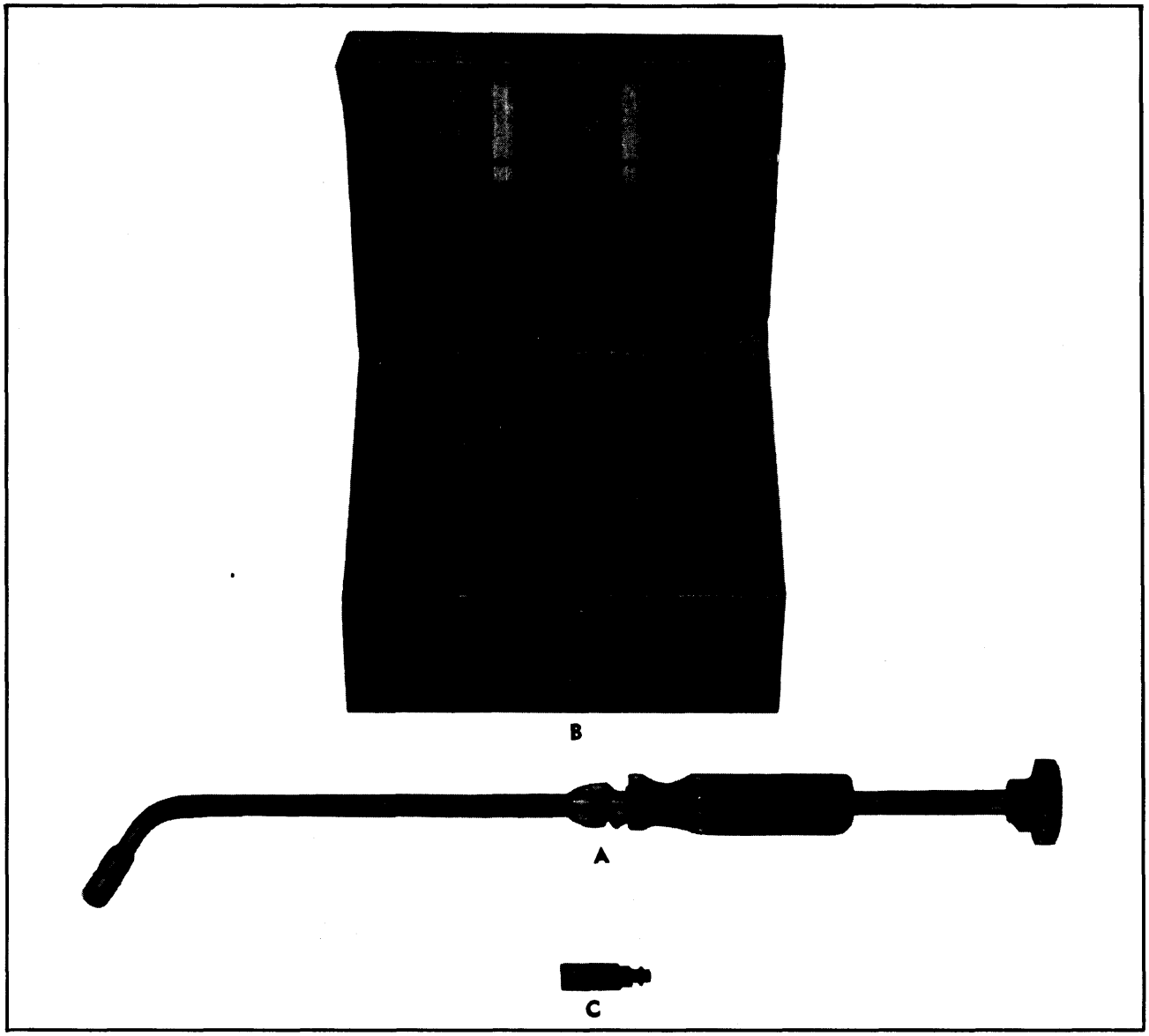


Fig. 6-109 Special Tools

Key	Tool Number	Name
A	J-22646	1/4" Hex-Head Extension Driver
B	J-9789-01	Universal Gage Set
C	J-22769	Seat Remover

BACK TO INDEX

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THEORY OF OPERATION
ELECTRONIC FUEL INJECTION
GENERAL DESCRIPTION

Electronic Fuel Injection (EFI) provides a means for controlling automobile engine exhaust emissions within the required limits by precisely controlling the air/fuel mixture for combustion. This is accomplished by monitoring selected engine operating conditions, and electronically metering the fuel requirements to meet those conditions.

EFI basically involves electrically actuated fuel metering valves which, when actuated, spray a predetermined quantity of fuel into the engine. These valves or injectors, Fig. 6-110, are mounted in the intake manifold with the metering tip pointed toward the head of the intake valve. This arrangement is commonly known as port injection. The injector opening is timed in accordance with the engine frequency so that the fuel charge is in place prior to the intake stroke for the cylinder.

Gasoline is supplied to the inlet of the injectors through the fuel rail at high enough pressure to obtain good fuel atomization and to prevent vapor formation in the fuel system during extended hot operation. When the solenoid operated valves are energized the injector metering valve (pintle) moves to the full open position and since the pressure differential across the valve is constant, the fuel quantity is changed by varying the time that the injector is held open.

The injectors could be energized all at one time (called continuous injection) or one after the other in phase with the opening of each intake valve (called sequential injection) or they can be energized in groups.

The Cadillac EFI System is a two-group system. In a two-group system, the eight injectors are divided into two groups of four each. Cylinders 1, 2, 7 and 8 form group 1 while group 2 consists of cylinders 3, 4, 5 and 6. All four injectors in a group are opened and closed simultaneously while the groups operate alternately.

The amount of air entering the engine is measured by monitoring the intake manifold absolute pressure, the inlet air temperature, and the engine speed (in rpm). This information, allows the Electronic Control Unit to compute the flow rate of air being inducted into the engine, and consequently, the flow rate of fuel required

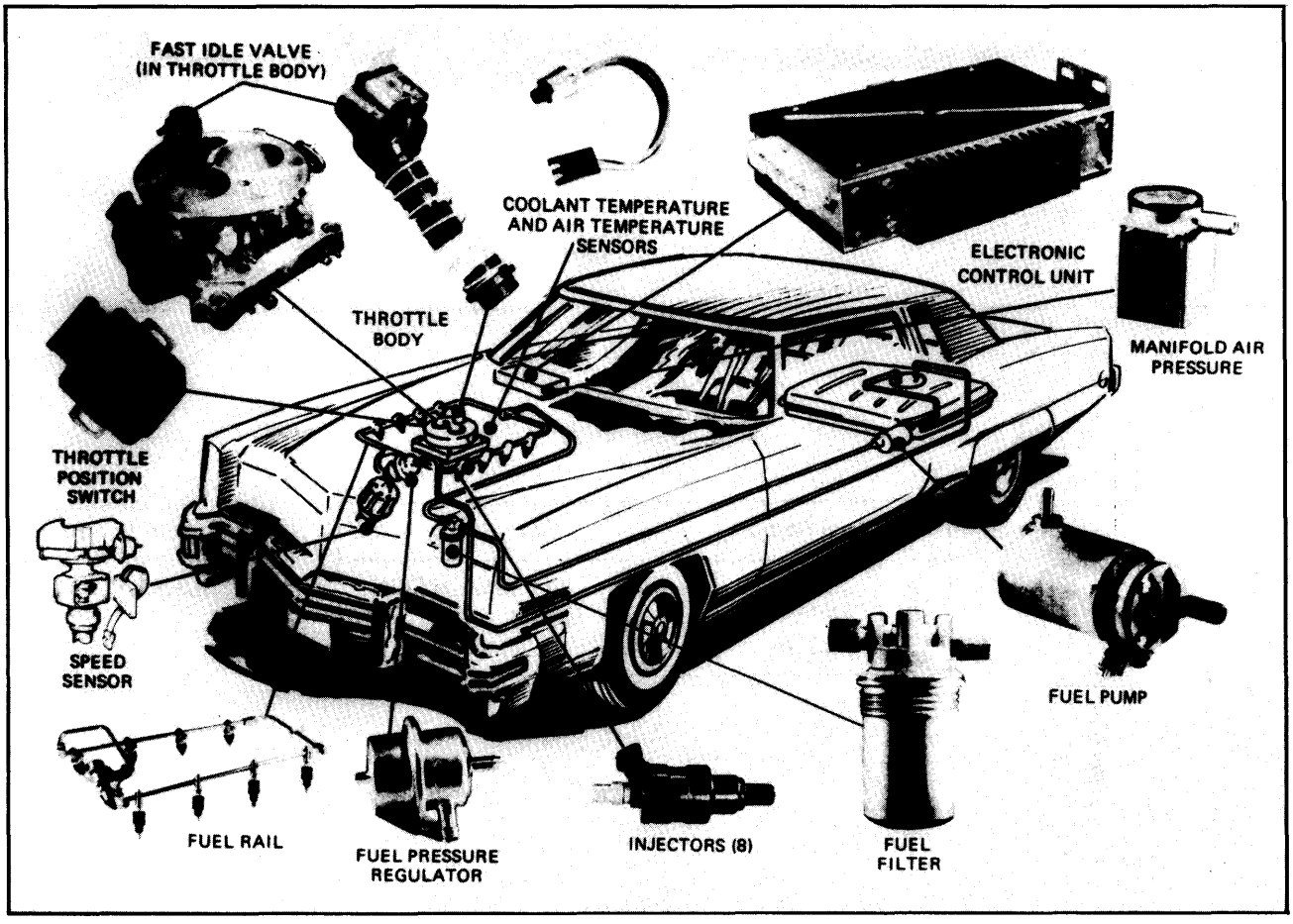


Fig. 6-110 EFI System Installation

BACK TO INDEX

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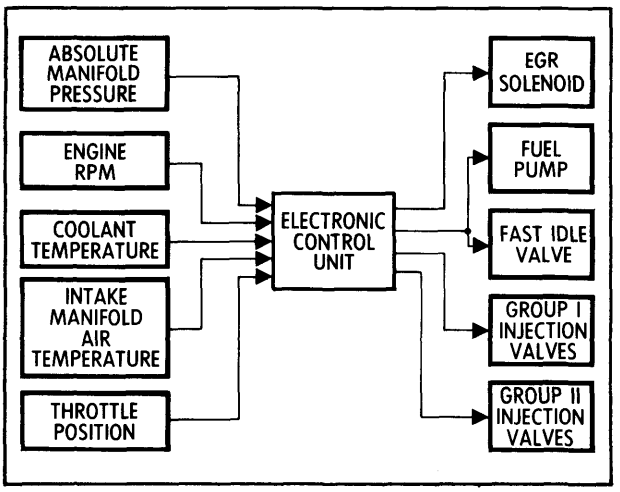


Fig. 6-111 Functional Block Diagram

to achieve the desired air/fuel ratio for the particular engine operating condition. Each of the groups are activated once for every revolution of the camshaft and two revolutions of the crankshaft.

The input/output block diagram shown in Fig. 6-111 represents Cadillac's two group EFI system. In this system, the prevailing engine conditions are monitored with sensors and provide information to the Electronic Control Unit (ECU). The ECU converts the multi-variable input information into an injector pulse width which opens the injectors for the proper duration and at the proper time with respect to the cylinder firing sequence.

The object of the ECU is to calculate fuel requirements for the engine for various combinations of inputs from the sensors to determine an injector pulse width to provide accurate control of the air/fuel ratio.

SYSTEM DESCRIPTION

The EFI System is comprised of four major subsystems: 1) Fuel Delivery, 2) Air Induction, 3) Sensors, and 4) Electronic Control Unit. The function of these separate subsystems is integrated into the system operation.

Fuel Delivery Subsystem

The fuel delivery system, Fig. 6-112, includes an in-tank boost pump, a chassis-mounted constant-displacement fuel pump, a fuel filter, the fuel rails, one injector for each cylinder, a fuel pressure regulator, and supply and return lines. The fuel pumps are activated by the electronic control unit (ECU) when the ignition is turned on and the engine is cranking or operating. (If the engine stalls or if the starter is not engaged, the fuel pumps will deactivate in approximately one second.) Fuel is pumped from the fuel tank through the supply line and the filter to the fuel rails. The injectors supply fuel to the engine cylinders in precisely timed bursts as a result of electrical signals from the ECU. Excess fuel is returned to the fuel tank.

The fuel delivery system components are as follows:

a. Fuel Tank

The fuel tank used on cars equipped with EFI incorporates a reservoir directly below the sending unit-in-tank pump assembly. The "bath tub" shaped reservoir is used to insure a constant supply of fuel for the in-tank pump even at low fuel level and severe maneuvering conditions. The fuel returned to the tank by the fuel pressure regulator is dumped directly into the reservoir as an additional means of keeping the pump intake below the fuel level.

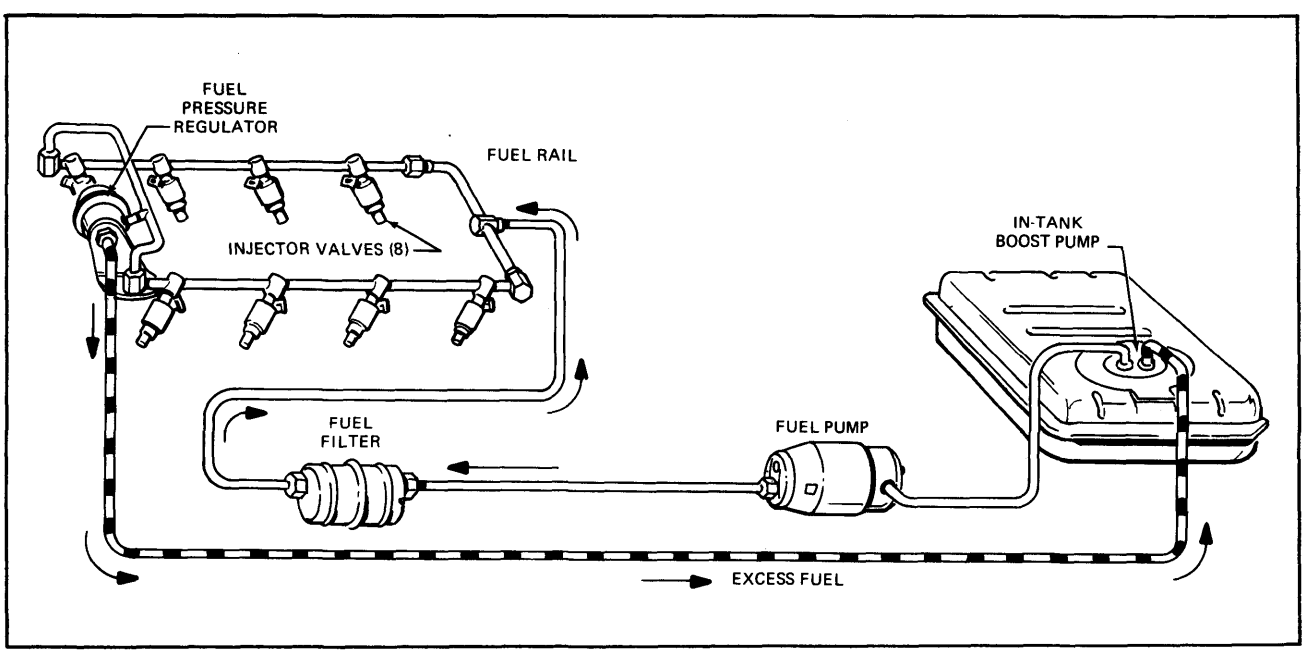


Fig. 6-112 Fuel Delivery System

BACK TO INDEX

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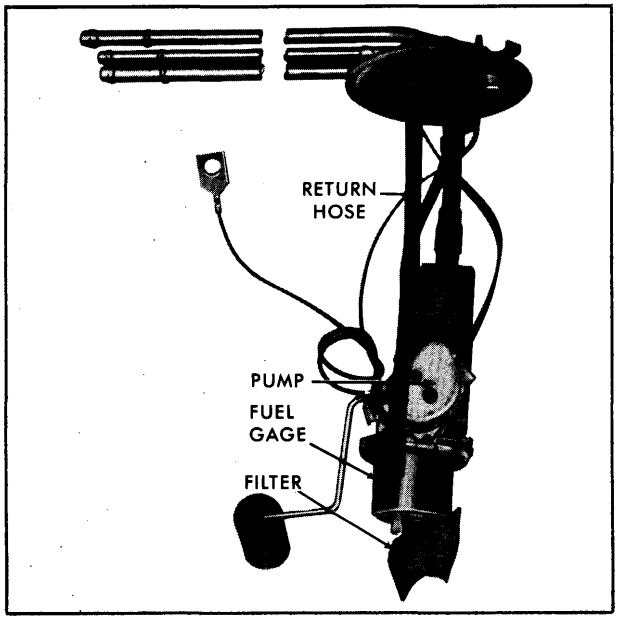


Fig. 6-113 In-Tank Pump

b. In-Tank Boost Pump

Two electric fuel pumps are used with the EFI system. Located inside the fuel tank and an integral part of the fuel gage tank unit, the in-tank pump, Fig. 6-113, is used to supply fuel to the chassis-mounted pump and to prevent vapor lock on the suction side of the system.

The chassis-mounted and in-tank fuel pumps are electrically connected in parallel to the ECU and are protected by an AGC-10 fuse located in the harness near the ECU.

c. Chassis-Mounted Fuel Pump

The Chassis-Mounted Fuel Pump, Fig. 6-112, is a constant-displacement, roller-vane pump driven by a 12 volt motor. The pump incorporates a check valve to prevent back-flow. This maintains fuel pressure when the pump is off. The pump has a flow rate of 33 gallons per hour under normal operating conditions (39 PSI). An internal relief valve provides over-pressure protection by opening at an excessive pressure (55-95 PSI). The pump is mounted under the vehicle, forward of the left rear wheel on all except Eldorado vehicles, and forward of the right rear wheel on the Eldorado, see Figs. 6-146 and 6-147.

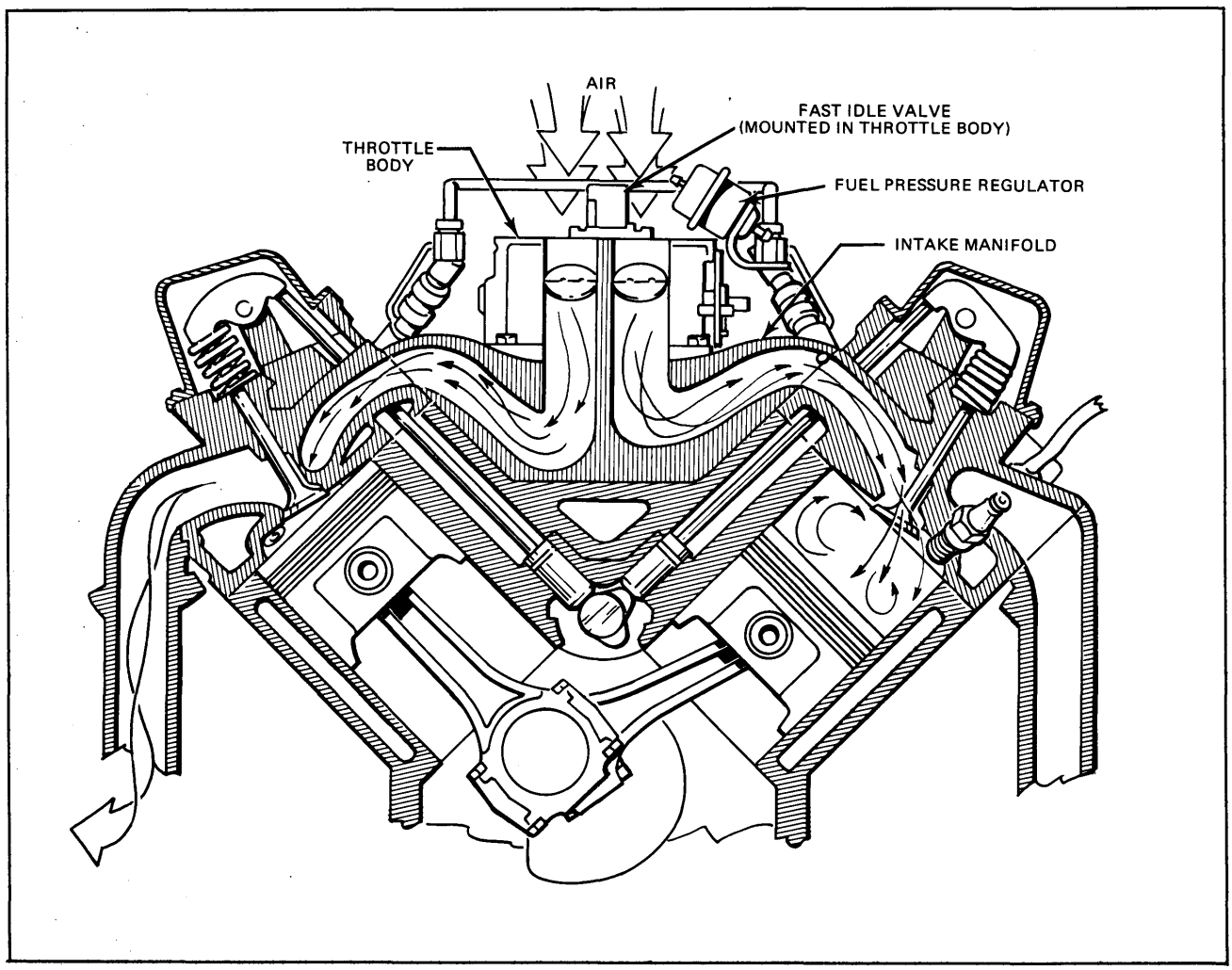


Fig. 6-114 Air Induction System

BACK TO INDEX

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d. Fuel Filter

The Fuel Filter, Fig. 6-112, consists of a casing with an internal paper filter element capable of filtering foreign particles down to the 20 micron size. The filter element is a throwaway type and should be replaced each 12 months or 15,000 miles. The filter is mounted to a bracket on the lower left front portion of the engine on all cars.

e. Fuel Pressure Regulator

The Fuel Pressure Regulator contains an air chamber and fuel chamber separated by a spring-loaded diaphragm. The air chamber is connected by a rubber hose to the throttle body assembly. The pressure in this chamber is identical to the pressure of the intake manifold. The changing manifold pressure and the spring, control the action of the diaphragm valve, opening or closing an orifice in the fuel chamber. (Excess fuel is returned to the fuel tank.) This regulator, being connected to the fuel rail and intake manifold, maintains a constant 39 psi differential across the injectors.

The fuel pressure regulator is mounted on the fuel rail toward the front of the engine, Fig. 6-112.

f. Injection Valve

The Injection Valve is a solenoid operated pintle valve that meters fuel to each cylinder. Based upon a pulsed signal from the electronic control unit, the valve opens for the proper time interval (pulse-width) to deliver the exact amount of fuel required. When energized, the valve sprays the fuel in fine droplets. When de-energized, it prevents further fuel flow to the engine. Handling of the injection valve requires special care to avoid possible damage to the metering tip. The injection valves are located on the intake manifold above the intake valve for each cylinder, Fig. 6-112.

Injection valves used on C and E Series cars are color coded Blue.

Air Induction Subsystem

The Air Induction subsystem, Fig. 6-114, consists of the throttle body assembly, fast idle valve assembly, and intake manifold.

Air for combustion enters the throttle body and is distributed to each cylinder through the intake manifold. The primary air flow rate is controlled by the throttle valves which are connected to the accelerator pedal linkage. An adjustable idle by-pass air passage is incorporated within the throttle body that allows a regulated amount of air to by-pass the throttle valves. The throttle blades are also pre-set slightly open when the throttle lever is resting against the idle stop position. This adjustment is not to be altered.

Additional air for cold starts and warm-up is provided through an electrically controlled fast idle valve, which is incorporated in the top of the throttle body.

The air induction system components are as follows:

a. Intake Manifold

The dual plane intake manifold is basically the same for EFI equipped vehicles as for carburetor equipped vehicles. The EFI intake manifold differs from the carburetor version in the following ways:

1. Only air is distributed to the intake port through the intake manifold.
2. The manifold contains a port above each cylinder for injection valve installation. The fuel is injected directly toward the top of the cylinder intake valve.
3. A port is available to receive the air temperature sensor.
4. No exhaust heat passage is used. The exhuast passages from the right cylinder head are used only for EGR.
5. The EGR passage delivers exhaust gas from the right cylinder head to an area just ahead of the manifold bores under the throttle body and then into the manifold.

b. Throttle Body

The throttle body, Fig. 6-114, consists of a housing with two bores and two shaft mounted throttle valves connected to the vehicle accelerator pedal by mechanical linkage. Fittings are incorporated to accommodate vacuum connections. The end of the throttle shaft opposite from the accelerator lever, controls the throttle position switch (described below under Engine Sensors). An adjustable set screw on the front of the throttle body enables adjustment of warm engine idle speed. Turning the screw clockwise restricts the air flow passing through the idle air channel, lowering the engine speed (rpm). Turning the screw counterclockwise permits a greater air flow, thereby increasing the engine idle speed.

A large port on top of the throttle body contains the fast idle valve.

c. Fast Idle Valve

The fast idle valve, Fig. 6-115, consists of a plastic body that houses an electric heater, a spring and plunger, and a thermal sensitive element.

The device is installed in the top of the throttle body. Electrically, it is connected to the fuel pump circuit through the electronic control unit. When the

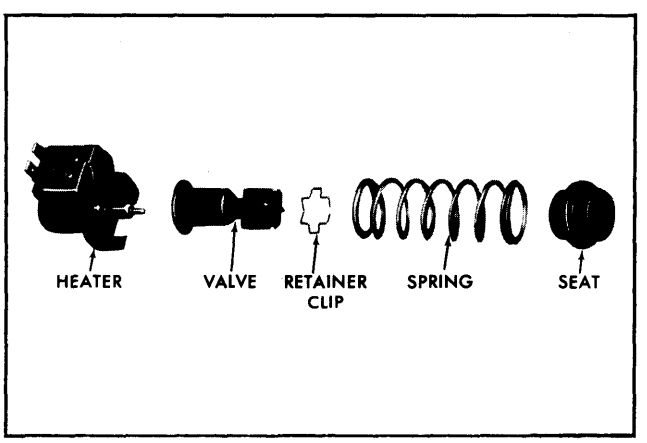


Fig. 6-115 Fast Idle Valve

BACK TO INDEX

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cold engine is started, the open valve allows supplemental air to bypass the throttle. The heater warms the thermal element which expands, forcing the spring and plunger toward the orifice, reducing the supplemental air flow thus reducing the engine speed to the normal level. The fast idle valve will have no further affect after the thermal element reaches approximately 140°F. (60°C). The rate of valve closure is a function of time and temperature. The warmer the ambient temperature, the faster the valve will close, reducing the engine idle speed. At 68°F (20°C), the valve will close in approximately 90 seconds; at -20°F (-29°C), the valve will require approximately 5 minutes to close.

Engine Sensors

The sensors are electrically connected to the Electronic Control Unit and all operate independently of each other. Each sensor transmits a signal to the ECU, relating a specific engine operating condition. The ECU analyzes all the signals and transmits the appropriate commands.

The sensors are as follows:

a. Manifold Absolute Pressure Sensor

The Manifold Absolute Pressure (MAP) Sensor, Fig. 6-116, monitors the changes in intake manifold pressure which result from engine load, speed and barometric pressure variations. These pressure changes are supplied to the electronic control unit circuitry in the form of electrical signals. The sensor also monitors the changes in the intake manifold pressure due to changes in altitude. As intake manifold pressure increases, additional fuel is required. The MAP sensor sends this information to the ECU so that the pulse width will be increased. Conversely as manifold pressure decreases the pulse width will be shortened.

The sensor is mounted within the electronic control unit. A manifold pressure line, routed with the engine harness, connects it to the front of the throttle body.

b. Throttle Position Switch

The Throttle Position Switch, Fig. 6-117, is mounted to the throttle body and connected to the throttle valve shaft. Movement of the accelerator causes the throttle shaft to rotate (opening or closing the throttle blades). The switch senses the shaft movement and position (closed throttle, wide open throttle, or position changes), and transmits appropriate electrical signals to the electronic control unit. The electronic control unit processes these signals to determine the fuel requirement for the particular situation.

c. Temperature Sensors

The Temperature Sensors, Fig. 6-118, (Coolant and Air) are comprised of a coil of high temperature nickel wire sealed into an epoxy case, and molded into a brass housing with two wires and a connector extending from the body. The resistance of the wire changes as a function of temperature. Low temperatures provide low resistance and as temperatures increase, so does resistance. The voltage drop across each sensor is monitored by the ECU.

The Air Temperature Sensor is located on the rear side of the intake manifold and is connected to the engine harness. The Coolant Temperature Sensor is located on the heater hose fitting at the rear of the right cylinder head.

Both temperature sensors are identical and completely inter-changeable.

d. Speed Sensor

The Speed Sensor, Fig. 6-119, is incorporated within the special ignition distributor assembly (HEI). It consists of two components. The first has two reed switches mounted to a plastic housing. The housing is affixed to the distributor shaft housing. The second is a rotor with two magnets, attached to and rotating with the distributor shaft.

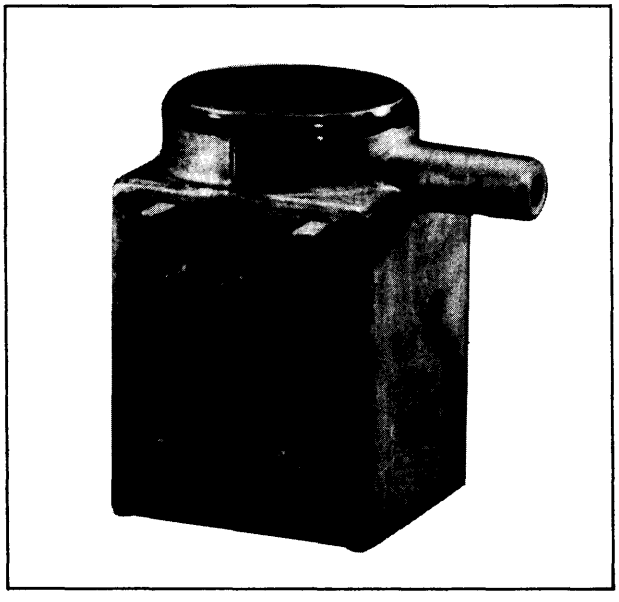


Fig. 6-116 MAP Sensor



Fig. 6-117 Throttle Position Switch

BACK TO INDEX

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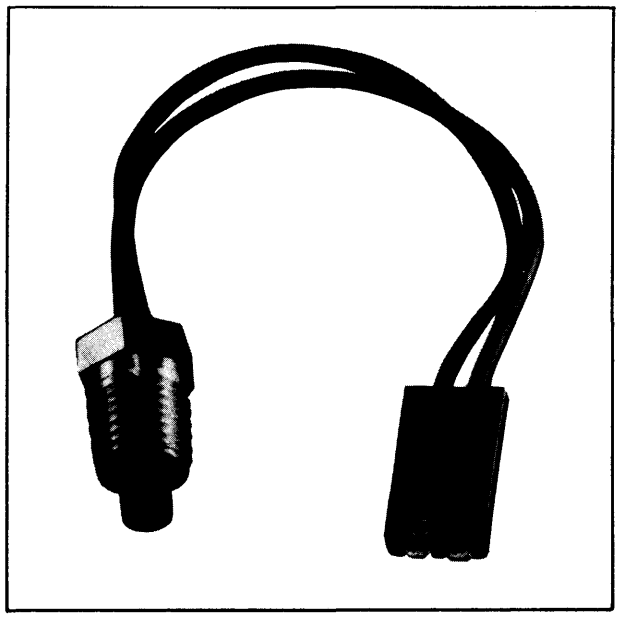


Fig. 6-118 Temperature Sensor

The rotor rotates past the reed switches causing them to open and close. This provides two types of information: synchronization of the ECU and the proper injector group with the intake valve timing (phasing); and engine rpm for fuel scheduling.

Electronic Control Unit

The electronic control unit, Fig. 6-120, is a preprogrammed analog computer consisting of custom electronic circuits housed in a steel case. The unit is installed above the glove box within the passenger compartment. It is electrically connected to the vehicle power supply and the other EFI components by a harness that is routed through the firewall.

The ECU receives power from the vehicle battery when the ignition is set to the ON or CRANK position. During cranking and engine operation, the following events occur.

The following information is received from the EFI sensors:

Engine Coolant Temperature
Intake Manifold Air Temperature
Intake Manifold Absolute Pressure
Engine Speed and Firing Position
Throttle Position and Change of Position

The following commands are transmitted by the ECU:

Electric Fuel Pump Activation
Fast Idle Valve Activation
Injection Valve Activation
EGR Solenoid Activation

The desired air/fuel ratios for various driving and atmospheric conditions are designed into the ECU. As the above signals are received from the sensors, the ECU processes the signals and computes the engines fuel requirements. The ECU issues commands to the injection valves to open for a specific time duration. The duration of the command pulses varies as the operating conditions change. All injection valves in each group open simultaneously upon command.

The EFI System is activated when the ignition switch is turned to the ON position. The following events occur at that moment:

1. The Electronic Control Unit (ECU) receives vehicle battery voltage.
2. The Fuel Pumps are activated by the ECU. (The pumps will operate for approximately one second only, unless the engine is cranking or running).
3. All engine sensors are activated and begin transmitting signals to the ECU.
4. The electrically heated Fast Idle Valve is activated. (The Fast Idle Valve is connected to the Fuel Pump electrical circuit and like the fuel pumps, will only be activated for approximately one second unless the vehicle is cranking or running. This action is controlled by the ECU.)
5. The EGR solenoid will be activated to block the vacuum signal to the EGR valve at coolant temperatures below 130°F. (60°C).

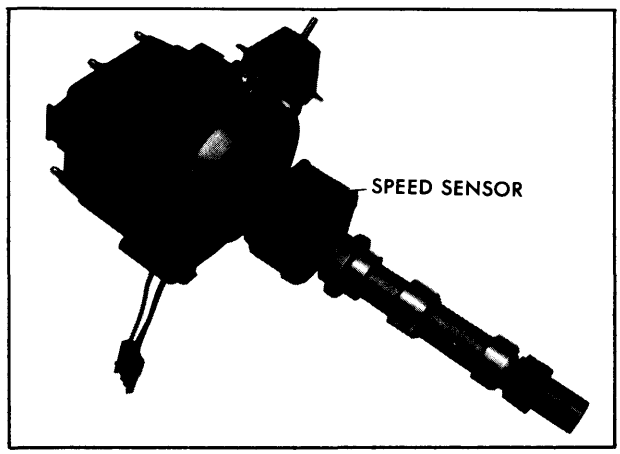


Fig. 6-119 Fuel Injection Distributor

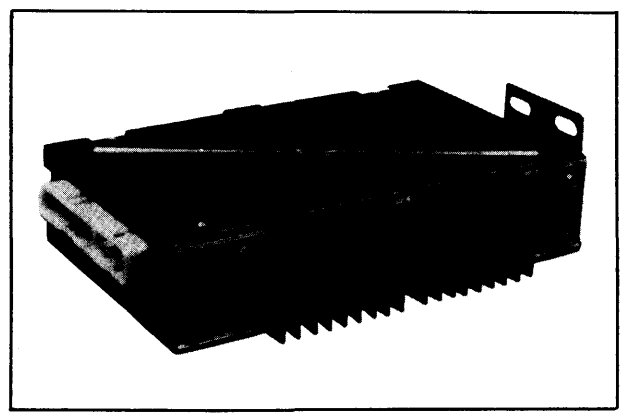


Fig. 6-120 Electronic Control Unit

BACK TO INDEX

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The following events occur when the engine is started:

1. The Fuel Pumps are activated for continuous operation.
2. The heater element of the Fast Idle Valve is activated for continuous operation.
3. The Throttle Body air-bypass controls the air flow to the intake manifold with the throttle valves closed. When the vehicle accelerator is depressed, the throttle valves open, creating an air flow similar to a carburetor.
4. The Fuel Pressure Regulator maintains the fuel pressure in the Fuel Rail (Injector inlet) at 39 psi higher than the intake manifold air pressure by returning excess fuel to the fuel tank.
5. The following signals from the primary sensors are continuously received and processed by the Electronic Control Unit.
   a. Engine Coolant Temperature
   b. Intake Manifold Air Temperature
   c. Intake Manifold Absolute Air Pressure
   d. Engine Speed and firing position
   e. Throttle Position changes or W.O.T. position
6. The ECU outputs electrical signals alternately to each injector group precisely controlling the opening and closing time (pulse width) to deliver fuel to the engine.

EFI Problem Diagnosis

The following charts present some specific problems and probable causes that do not require use of the tester.

ENGINE CRANKS BUT WILL NOT START

(NOTE: The following problems assume that the rest of the car electrical system is functioning properly.)

1. Blown 10 amp in-line fuel pump fuse located below instrument panel near ECU connectors.*
2. Open circuit in 12 purple wire between starter solenoid and ECU.
3. Open circuit in 18 dark green wire between generator "BAT" terminal and ECU (fusible link).*
4. Poor connection at ECU jumper harness (below instrument panel) or at ECU.
5. Poor connection at fuel pump jumper harness (below instrument panel near ECU), 14 dark green wire.*
6. Poor connection at engine coolant sensor or open circuit in sensor or wiring (cold engine only).**
7. Poor connection at distributor trigger (speed sensor).
8. Distributor trigger (speed sensor) stuck closed.
9. Malfunction in chassis-mounted pump.
10. Malfunction in throttle position switch (W.O.T. section shorted). To check, disconnect switch—engine should start.
11. Fuel flow restriction.

HARD STARTING

1. Open engine coolant sensor (cold or partially warm engine only – starts ok hot).**
2. Malfunction in throttle position switch (W.O.T. section shorted). To check, disconnect switch—Engine should start normally.
3. Malfunction in chassis-mounted fuel pump. (Check valves leaking back).
4. Malfunction in pressure regulator.

POOR FUEL ECONOMY

1. Disconnected or leaking MAP sensor hose.
2. Disconnected vacuum hose at fuel pressure regulator or at throttle body.
3. Malfunction of air or coolan sensor.***

ENGINE STALLS AFTER START

1. Open circuit in 12 black/yellow ignition signal wire between fuse block and ECU or poor connection at connector (12 black/yellow wire) located below instrument panel near ECU.
2. Poor connection at engine coolant sensor or open circuit in sensor or wiring (cold or warm engine only).**

BACK TO INDEX

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ROUGH IDLE

1. Disconnected, leaking or pinched MAP sensor hose. If plastic harness line requires replacement, replace entire EFI engine harness.
2. Poor connection at air or coolant sensor or open circuit in sensor or wiring (cold engine only).**
3. Poor connection at injection valve(s).
4. Shorted engine coolant sensor.***
5. Speed sensor harness located to close to secondary ignition wires.

PROLONGED FAST IDLE

1. Poor connection at fast idle valve or open circuit in heating element.
2. Throttle position switch misadjusted.
3. Vacuum Leak.

NO FAST IDLE

1. Bent fast idle valve micro switch causing heater to malfunction and drive valve section down to locked closed position.

ENGINE HESITATES OR STUMBLES ON ACCELERATION

1. Disconnected, leaking on pinched MAP sensor hose. If plastic harness line requires replacement, replace entire EFI engine harness.
2. Throttle position switch misadjusted.
3. Malfunction in throttle position switch.
4. Intermittent malfunction in distributor trigger (speed sensor).
5. Poor connection at 6 pin connector of ECU.
6. Poor connection at EGR solenoid or open solenoid (cold engine only).

LACK OF HIGH SPEED PERFORMANCE

1. Misadjusted throttle position switch (W.O.T. only).
2. Malfunction in throttle position switch.
3. Malfunction of chassis-mounted fuel pump.
4. Intermittent malfunction in distributor trigger (speed sensor).
5. Fuel filter blocked or restricted.
6. Open circuit in 12 purple wire between starter solenoid and ECU.

*To check, listen for chassis-mounted fuel pump "Whine" (one second only) as key is turned to "ON" position (not to "START" position).

**To check for an "open" circuit in an EFI temperature sensor, connect an ohmmeter to the sensor connector terminals. If the sensor resistance is greater than 1600 ohms, replace the sensor.

***To check for a "closed" (short) circuit in an EFI temperature sensor, connect an ohmmeter to the sensor connector terminals. If the sensor resistance is less than 700 ohms, replace the sensor.

BACK TO INDEX

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DIAGNOSIS OF PROBLEMS

Relationship Between Electronic Fuel Injection and Carburetor Components

The primary functional relationship of the carburetor and electronic fuel injection system components are identified below. The relationships while not directly interchangeable with regard to performance and resulting behavior, may prove valuable for diagnosis purposes.

Carburetor Vehicles	EFI Vehicles
Accelerator Pump	Throttle Position Switch
Fast Idle Cam	Electric Fast Idle Valve
Float	Fuel Pressure Regulator
Power Valve/Metering Rods	Manifold Absolute Pressure Sensor
Metering Jets and Idle Fuel System	Injection Valves, ECU

69. Testing Electronic Fuel Injection Using Analyzer J-25400

a. Visual Inspection

The following visual inspections should be performed prior to diagnostic testing.

1. Visually check all wiring harness connections for:
   a. Loose or detached connectors
   b. Broken or detached wires
   c. Terminals not completely seated in connector housing
   d. Partially broken or frayed wires at terminal connection.
   e. Shorting between wires
   f. Excessive corrosion
2. Visually check all vacuum lines (idle by-pass passage on top of throttle body may be plugged with a clean shop towel to make it easier to hear vacuum leaks):
   a. To insure all lines are securely connected to their proper fittings, Fig. 6-121.
   b. For broken, pinched or cracked lines.
3. Visually check fuel lines for:
   a. Leakage
   b. Kinks in rubber and steel fuel lines.

b. Preliminary Diagnosis

Listed below are typical problems that might be experienced during operation of a vehicle with electronic fuel injection, the problems are traceable to the electronic fuel injection system with the understanding that the vehicle electrical system and other mechanical systems (ignition, valve timing, etc.) are in sound operating condition.

ENGINE CRANKS BUT WILL NOT START	PERFORM TEST STEP
1. Electrical Connections	Visual Inspection
2. Fuel Pump Circuit	2
3. Cranking Circuit	2
4. Coolant Sensor	10
5. Speed Sensor	7
6. Throttle Position Switch	12
7. Fuel Delivery System	17
8. ECU	19, 20

HARD STARTING	
1. Coolant Sensor	10
2. Throttle Position Swtich	12
3. Fuel Delivery System	17

POOR FUEL ECONOMY	
1. MAP Sensor Hose	Visual Inspection*
2. Vacuum Hoses	Visual Inspection
3. Coolant Sensor	10
4. Air Sensor	9

ENGINE STALLS AFTER START	
1. Ignition Circuit	2
2. Coolant Sensor	10
3. ECU	19, 20

ROUGH IDLE	
1. MAP Sensor Hose	Visual Inspection*
2. ALC System Cycling	Inspect
3. Coolant Sensor	10
4. Speed Sensor	7
5. Air Sensor	9
6. Injection Valves	3, 4, 17
7. ECU	19, 20

PROLONGED FAST IDLE	
1. Fast Idle Valve	5
2. Throttle Position Switch	11
3. Vacuum Hoses	Visual Inspection
4. Air Leaks	Visual Inspection

ENGINE HESITATES OR STUMBLES ON ACCELERATION	
1. MAP Sensor Hose	Visual Inspection*
2. Throttle Position Switch	11, 12, 13, 14
3. Speed Sensor	7, 20
4. EGR Solenoid	6
5. EGR Vacuum Hoses	Visual Inspection
6. Injection Valves	3, 4, 17
7. Temperature Sensors	9, 10
8. ECU	19, 20

LACK OF HIGH SPEED PERFORMANCE	
1. Linkage Adjustment	Adjust
2. Throttle Position Switch	11, 12, 13, 14
3. Fuel Delivery System	17
4. Speed Sensor	7, 20
5. Cranking Circuit (Cuts out at W.O.T.)	2

BACK TO INDEX

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*To check MAP sensor hose, disconnect hose from throttle body fitting, Fig. 6-121. Connect vacuum pump J-23738 or equivalant to hose and apply 15" vacuum to hose. If pressure falls off rapidly, hose is leaking, (a slow pressure drop may be due to leaking check valve in vacuum pump). If hose checks OK, disconnect hose at ECU and apply shop air pressure to nylon harness hose at this point. A substantial air-flow should be observed at throttle body end of hose.

CAUTION: Do not apply shop air pressure to MAP sensor hose if hose is connected to ECU as damage may result.

If MAP sensor plastic harness line requires replacement, replace entire EFI engine harness.

c. Connecting Analyzer

1. Depress Analyzer Switch #1 (off).
2. Turn Car Ignition Switch off.
3. Set Parking Brake on.
4. Set Transmission in Park.
5. Install Analyzer Extender Harness J-25400-12 to the analyzer, Fig. 6-122.
6. Select analyzer Overlay J-25400-11 and place it on the analyzer panel retaining it in place.
7. Turn Analyzer Fuel Pump switch off.
8. Disconnect the 5 ECU Jumper Harness Connectors located near the right hand kick pad. Plug these connectors into the "car side" connectors on the Analyzer Harness Adapter as shown in Fig. 6-122. DO NOT CONNECT THE E.C.U. SIDE OF THE JUMPER HARNESS TO THE ANALYZER AT THIS TIME.
9. Connect analyzer ground lead to a good ground such as at right hand courtesy lamp metal bracket.

(NOTE: Car electrical equipment could interfere with correct operation of the EFI Analyzer. Therefore, it is important that all of this equipment is OFF during testing. This includes lights, buzzers, electric motors, etc. Doors should be kept closed to deactivate interior lighting, buzzers, and seat solenoids.)

10. Push ENRICHMENT SWITCH on extender box to "off" position.
11. POWER TO TESTER light should be on indicating power to analyzer. If light fails to come on, check ground connection. If ground is OK check fusible link at generator BAT terminal 10 AMP in-line fuse in car harness and 5 AMP fuse in analyzer extender box, Fig. 6-123.

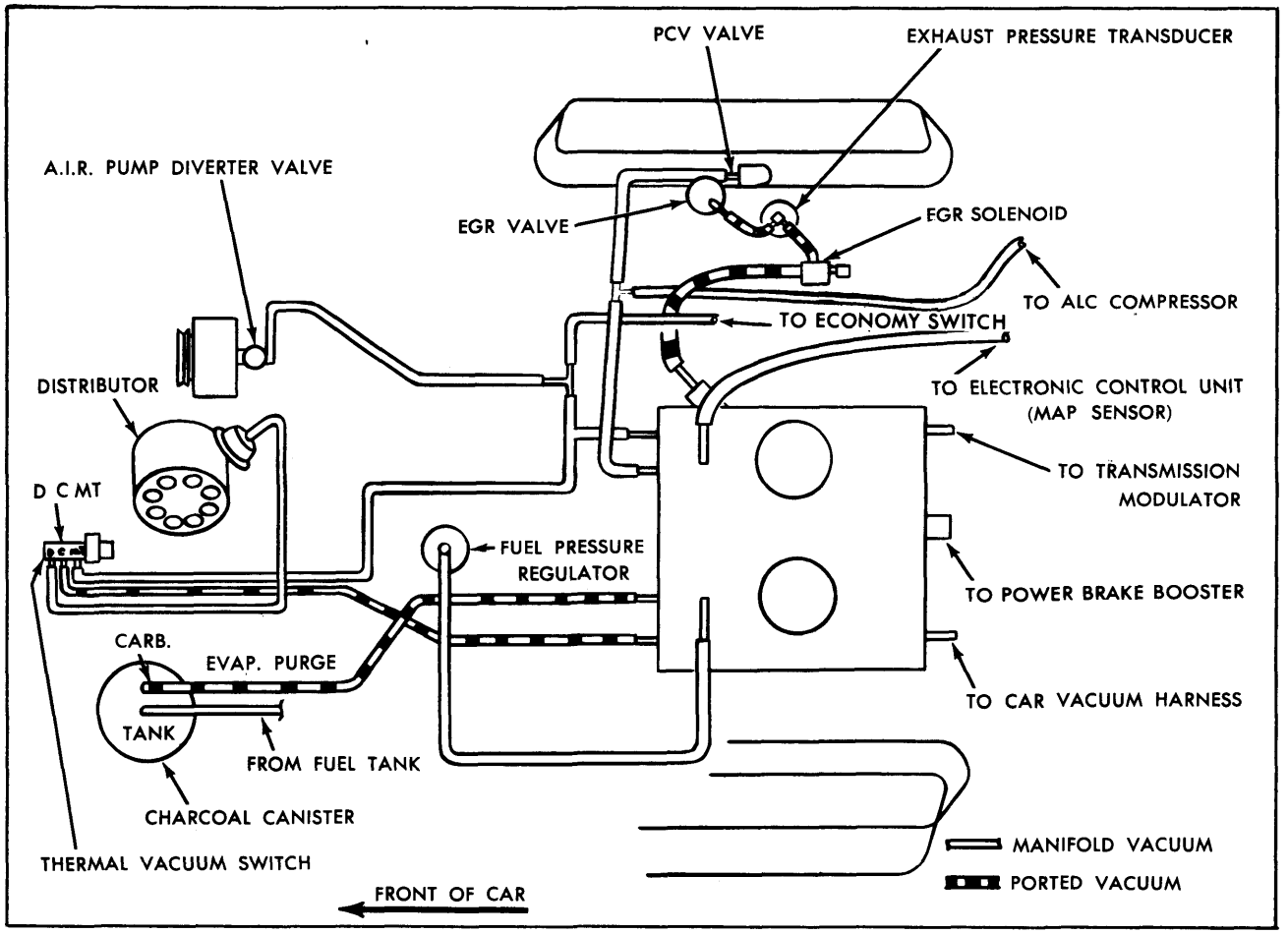


Fig. 6-121 Vacuum Hose Schematic

BACK TO INDEX

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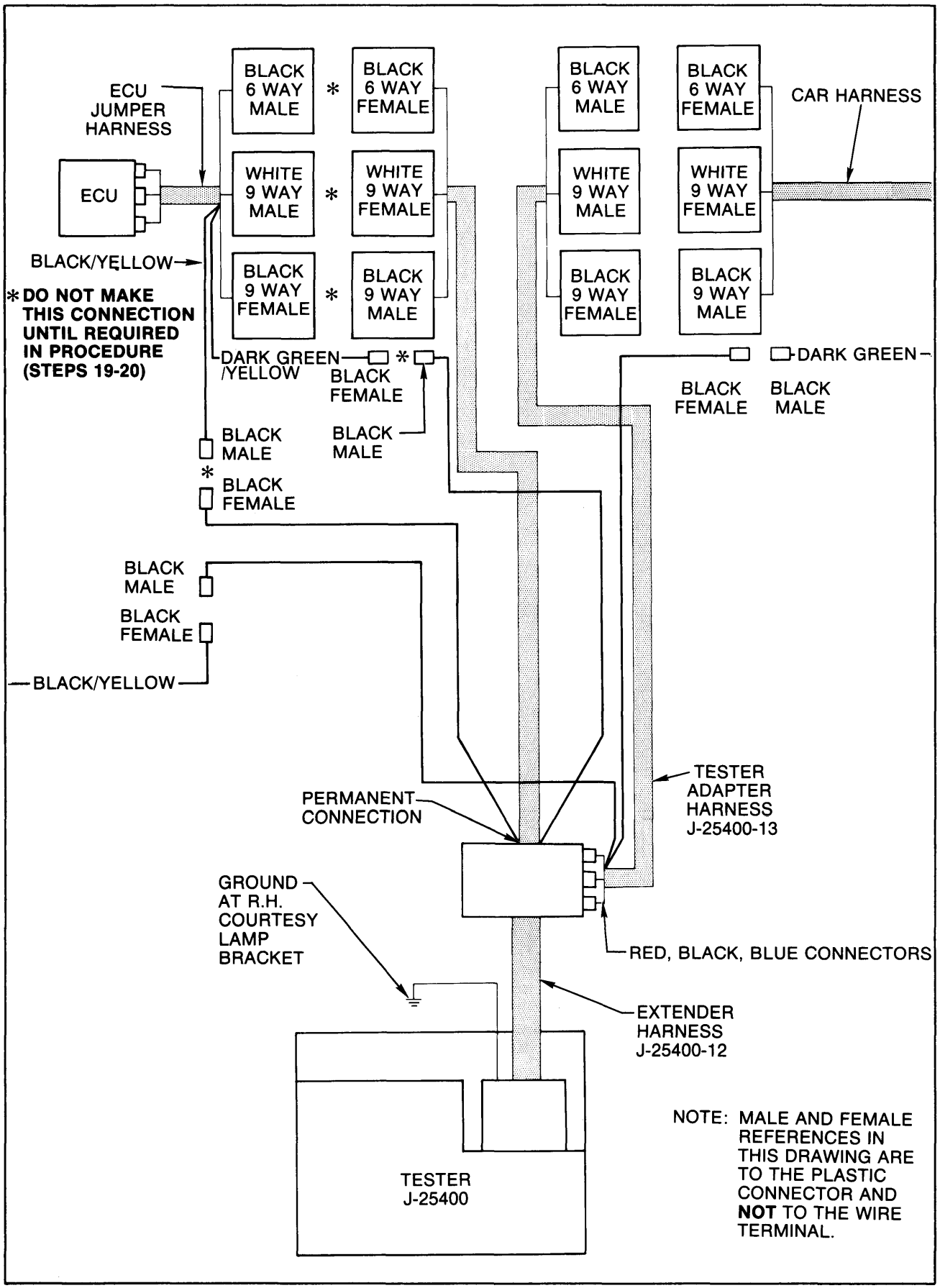


Fig. 6-122 Tester Connections

BACK TO INDEX

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STEP 1. CONNECT ANALYZER AS DESCRIBED IN PART C.
STEP 2. BATTERY VOLTAGE AND CALIBRATION.

A. Depress Analyzer Switch #2.
B. Analyzer POWER TO TESTER light should be **on**. If light fails to come on, check in line 10 amp fuse, 5 amp fuse in analyzer extender box and fusible link at generator BAT terminal for open, Fig. 3. If fuse continually blows:
   1. Check 14 dark green wire for short circuit.
   2. Check in-tank fuel pump assembly for short circuit. Refer to Step 17.
   3. Check fast idle valve circuit for short circuit. Refer to Step 5.
   4. Check ECU. Refer to Steps 18 and 20c.
C. Calibrate the analyzer by pushing the PUSH TO CALIBRATE button. With button depressed: Adjust the knob until DIGITAL METER reads 88.8.

(NOTE: Tester is not functioning correctly if this value cannot be obtained.)

D. Release CALIBRATE button.
E. The DIGITAL METER should read **above 11.5 volts**. (Battery voltage to ECU). If reading is **less than 11.5 volts**, check battery condition, harness (14 yellow brown wire and 14 dark green wires, Fig. 3), and connections.
F. Turn Car Ignition **on**.
G. Analyzer IGNITION ON Light should be **on**. If light is **not on**, check 12 black/yellow wire between ignition switch and ECU jumper harness for poor connection or open circuit (should be at least 9.5 volts), Fig. 4.
H. Turn the Car Ignition Switch to the START position and note the following while engine is cranking:
   1. ENGINE CRANK Light should come **on**. If lamp is **not on**, inspect 12 purple wire between starter solenoid and ECU jumper harness for continuity, Fig. 5.
   2. The DIGITAL METER readout should not drop **below 9.0 volts** (cranking voltage). If voltage drops **below 9.0** check battery before proceeding with test (12 purple wire from starter solenoid should have at least 9.0 volts during cranking).
I. Return Car Ignition Switch to **off**.

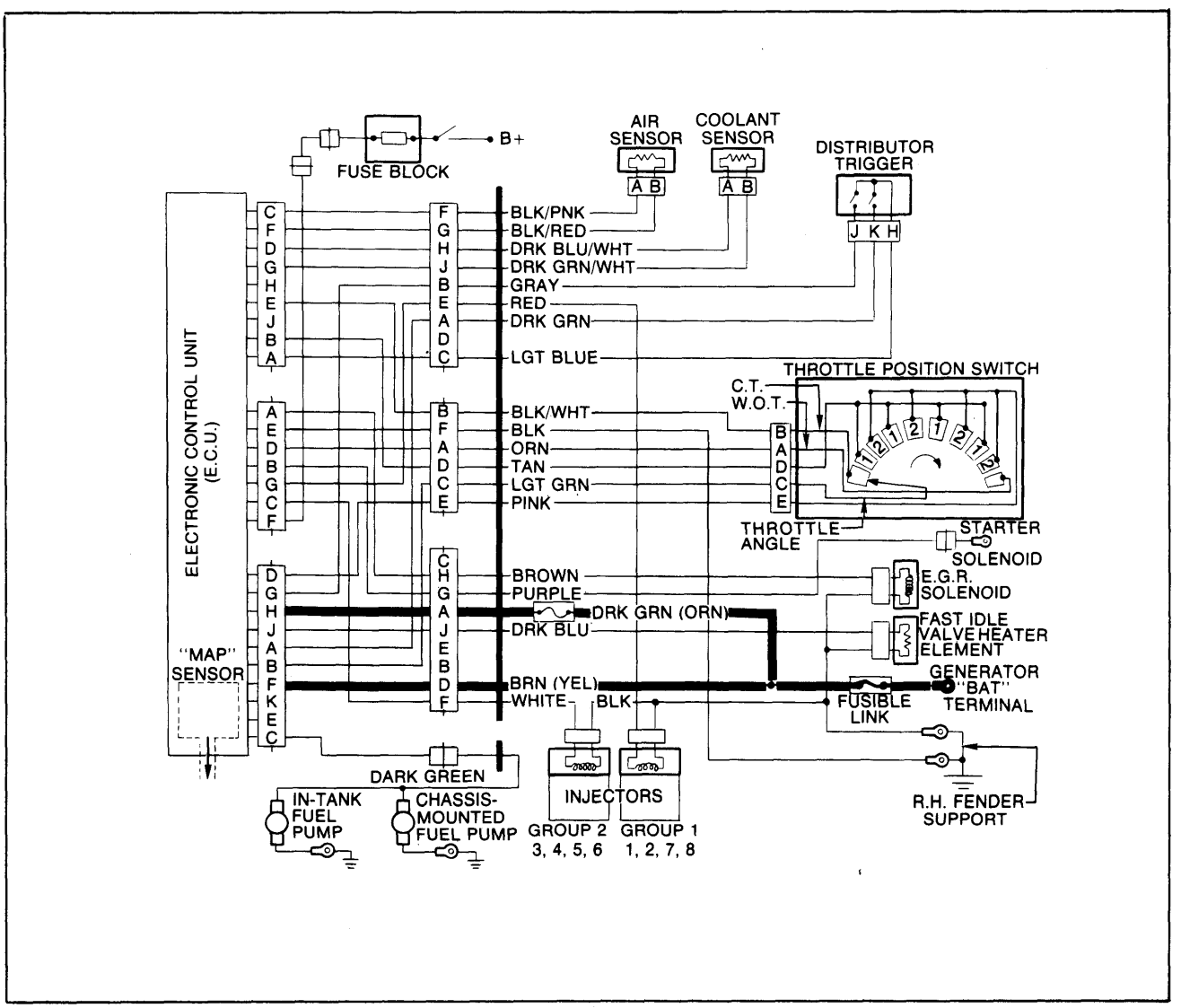


Fig. 6-123 Component Testing—Step 2

BACK TO INDEX

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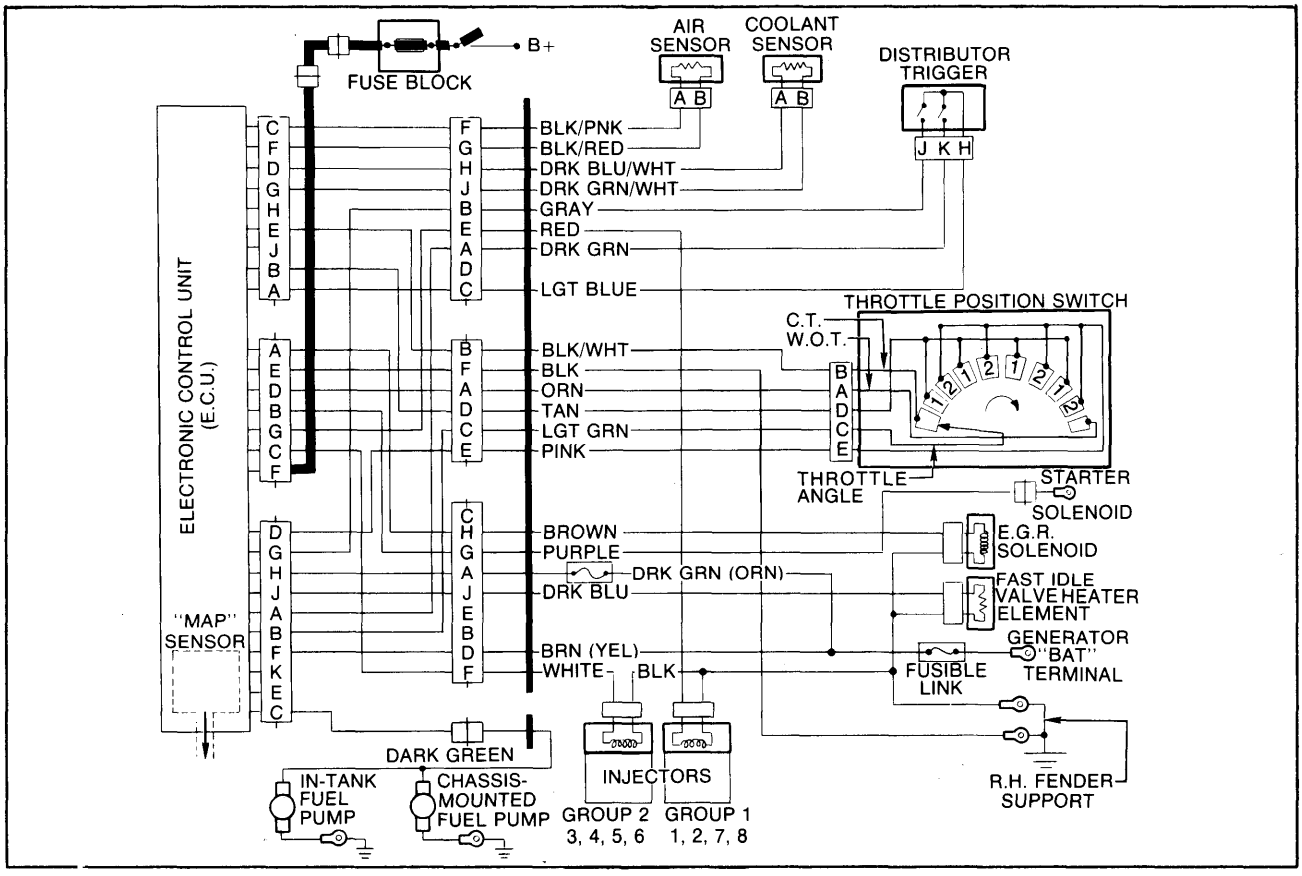


Fig. 6-124 Component Testing—Step 2

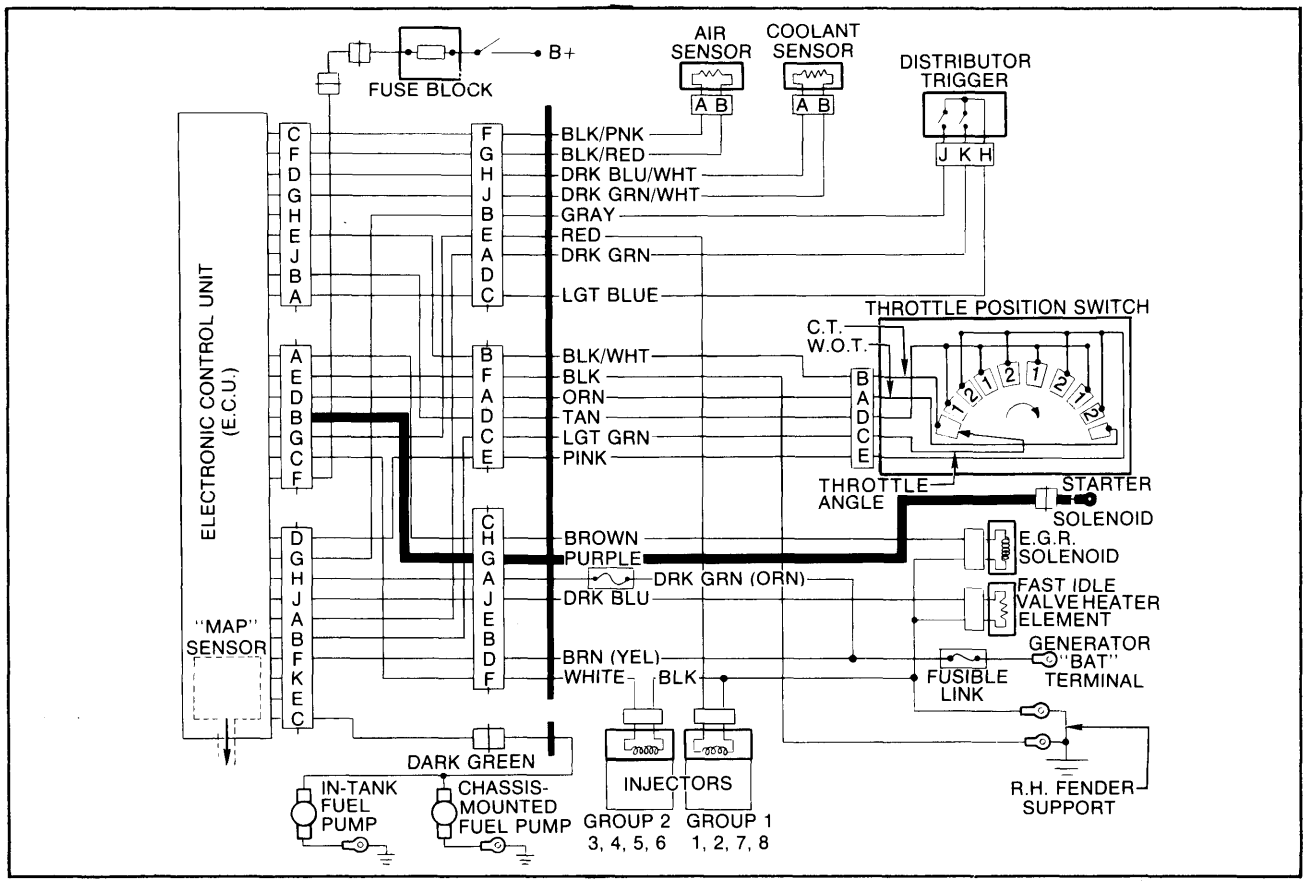


Fig. 6-125 Component Testing—Step 2

BACK TO INDEX

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STEP 3. INJECTOR GROUP 1 TEST (INJECTORS 1, 2, 7, 8)

A. Depress Analyzer Switch #3. Test each individual injector by disconnecting the other 3 injectors in the group.
   1. DIGITAL METER should read **between 2.4 and 3.0** for each of the four injectors. If reading is OK, proceed to step 4.
   2. If DIGITAL METER reads **more than 3.0**, and/or OPEN CIRCUIT light indicates an open circuit, short the harness terminals together.
      a. If DIGITAL METER reads **less than .5**, replace the injector.
      b. If DIGITAL METER reads **more than .5**, inspect 18 red wire for continuity and terminal at jumper harness for poor connection, Fig. 6. If red wire is OK, inspect ground wire and ground connection (18 black wire) at right front fender support for poor connection, Fig. 6 Also inspect injector connector. Repair and retest.
   3. If DIGITAL METER reads **less than 2.4**, inspect 18 red wire between injector connector and ECU jumper harness for short circuit, Fig. 6. Repair and retest.

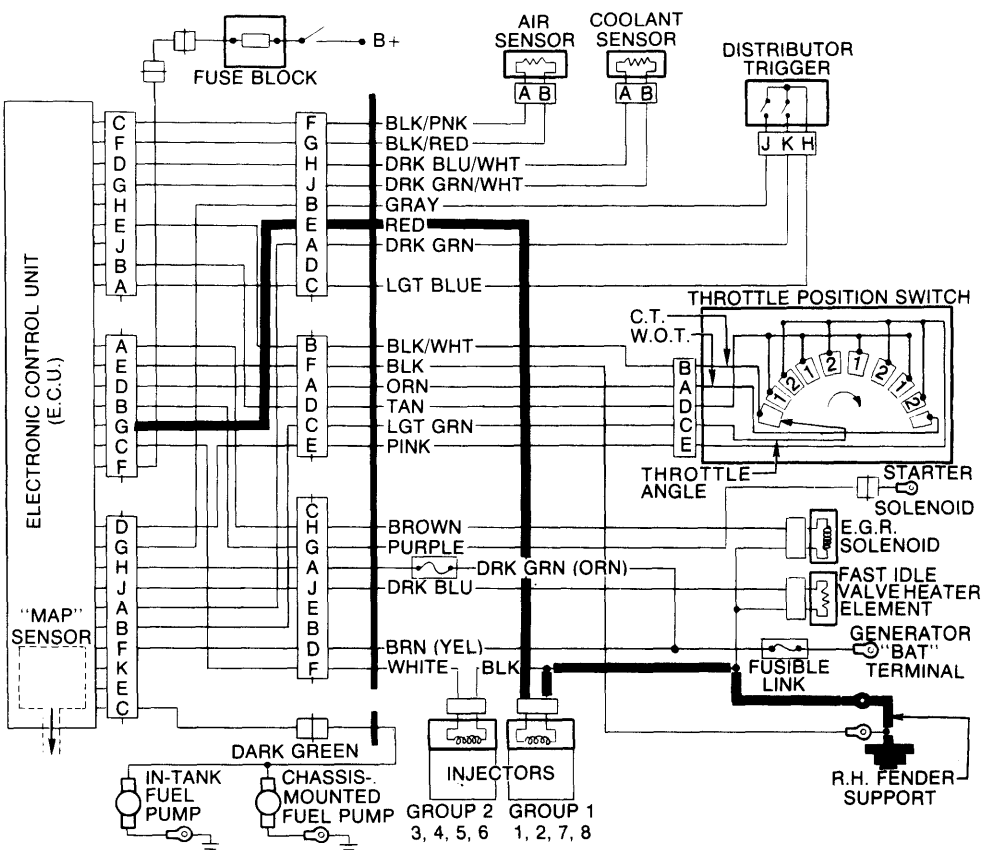


Fig. 6-126 Component Testing—Step 3

BACK TO INDEX

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STEP 4. INJECTOR GROUP 2 TEST (INJECTORS 3, 4, 5, 6)

A. Depress Analyzer Switch #4. Test each individual injector by disconnecting the other 3 injectors in the group.
   1. DIGITAL METER should read **between 2.4 and 3.0** for each of the four injectors. If reading is OK, proceed to Step 5.
   2. If DIGITAL METER reads **more than 3.0,** and/or OPEN CIRCUIT light indicates an open circuit, short the harness terminals together.
      a. If DIGITAL METER reads **less than .5,** replace the injector.
      b. If DIGITAL METER reads **more than .5,** inspect 18 white wire for continuity and terminal at jumper harness for poor connection, Fig. 7. If white wire is OK, inspect ground wire and ground connection (18 black wire) at right front fender support for poor connection, Fig. 7. Also inspect injector connector. Repair and retest.
   3. If DIGITAL METER reads **less than 2.4,** inspect 18 white wire between injector connector and ECU jumper harness for short circuit, Fig. 7. Repair and retest.

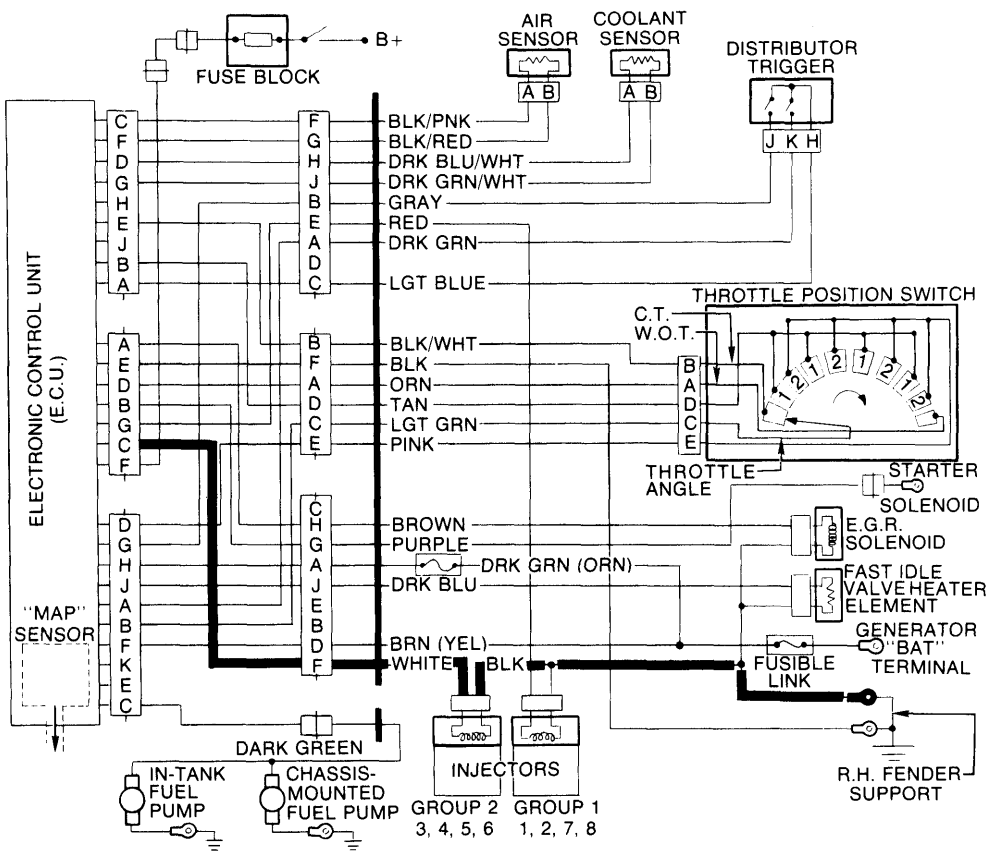


Fig. 6-127 Component Testing—Step 4

BACK TO INDEX

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STEP 5. FAST IDLE VALVE

A. Depress Analyzer Switch #5.
   1. If DIGITAL METER reads between **10 and 35,** proceed to Step 6.
   2. If DIGITAL METER reads **more than 35** and/or OPEN CIRCUIT light indicates an open, proceed to Part "B".
   3. If DIGITAL METER reads **less than 10,** proceed to Part "C".

B. Disconnect Engine Harness from Fast Idle Valve and short 20 Dark Blue wire to ground.
   1. If OPEN CIRCUIT light goes **out** or if DIGITAL METER reads **less than 20,** replace Fast Idle Valve. Retest after repair.
   2. If OPEN CIRCUIT light remains on, inspect 20 Dark Blue wire between fast idle valve and ECU jumper harness for open circuit or poor connection, Fig. 8. If 20 Dark Blue has continuity, inspect 18 black wire between fast idle valve connector and ground at right hand fender for open circuit or poor connection, Fig. 8.
   3. Repair and retest.

C. Disconnect Wiring Harness from Fast Idle Valve.
   1. If OPEN CIRCUIT light comes **on** replace fast idle valve. Retest after repair.
   2. If DIGITAL METER reads **less than 10,** inspect 20 dark blue wire between fast idle valve connector and ECU jumper harness for short circuit, Fig. 8.
   3. Repair and retest.

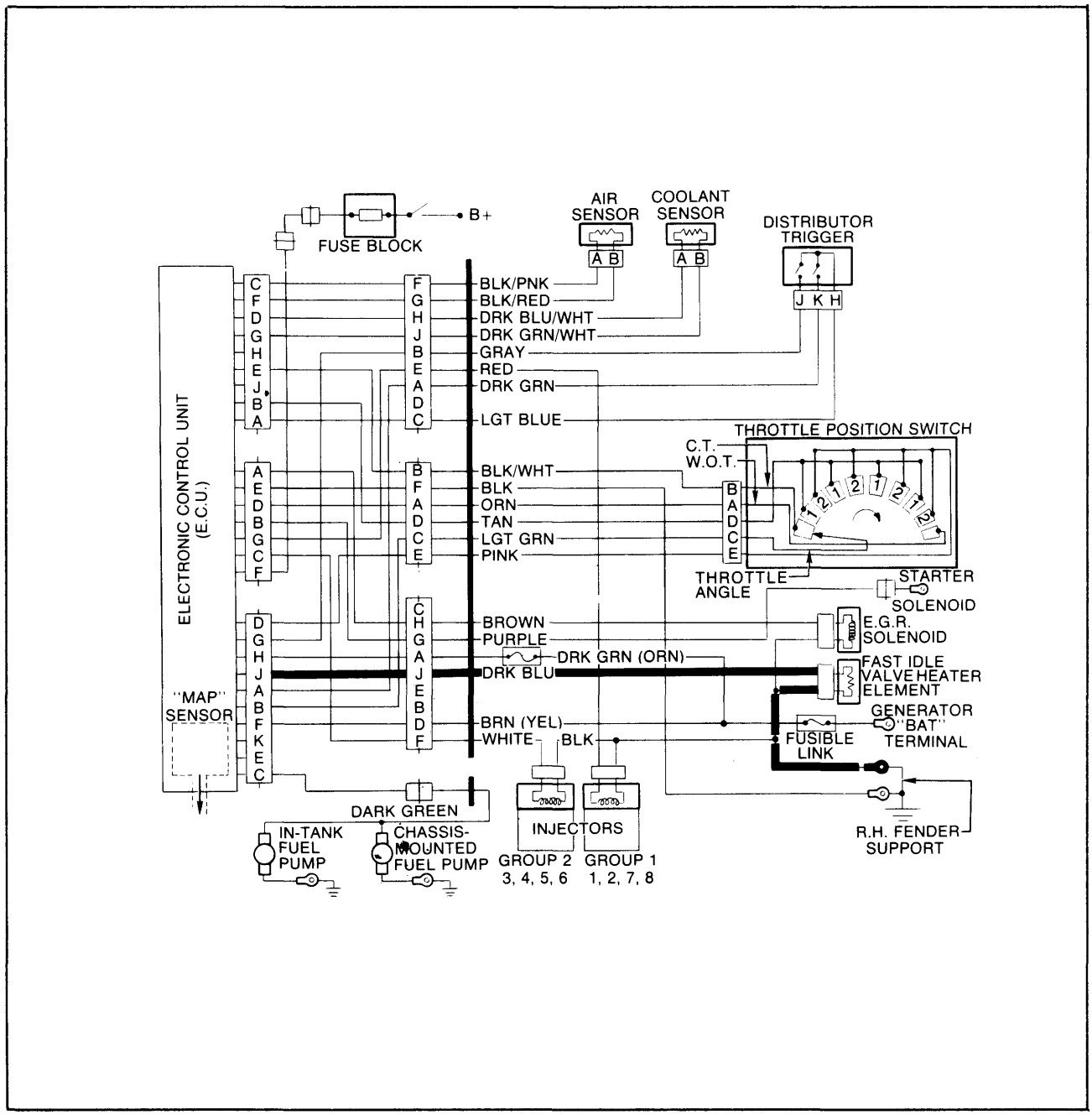


Fig. 6-128 Component Testing—Step 5

BACK TO INDEX

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STEP 6. EGR VALVE SOLENOID

A. Depress Analyzer Switch #6.
   1. If DIGITAL METER reads **between 40 and 60** proceed to Step 7.
   2. If DIGITAL METER reads **more than 60,** and/or OPEN CIRCUIT light indicates an open, proceed to Part "B".
   3. If DIGITAL METER reads **less than 40,** proceed to Part "C".

B. Disconnect Engine Harness from EGR Solenoid and connect a jumper between the harness terminals.
   1. If OPEN CIRCUIT light goes **out** or DIGITAL METER reads **less than .5,** replace EGR solenoid. Retest after repair.
   2. If OPEN CIRCUIT light remains **on,** inspect 14 brown wire between EGR solenoid and ECU jumper harness for open circuit or poor connection, Fig. 9. If brown wire has continuity, inspect 18 black wire between solenoid connector and ground at right hand fender for open circuit or poor connection, Fig. 9.
   3. Repair and retest.

C. Disconnect Wiring Harness from EGR solenoid.
   1. If open CIRCUIT LIGHT comes **on,** replace EGR solenoid. Retest after repair.
   2. If DIGITAL METER still reads **less than 40,** inspect 14 brown wire between EGR solenoid connector and ECU jumper harness for short circuit, Fig. 9.
   3. Repair and retest.

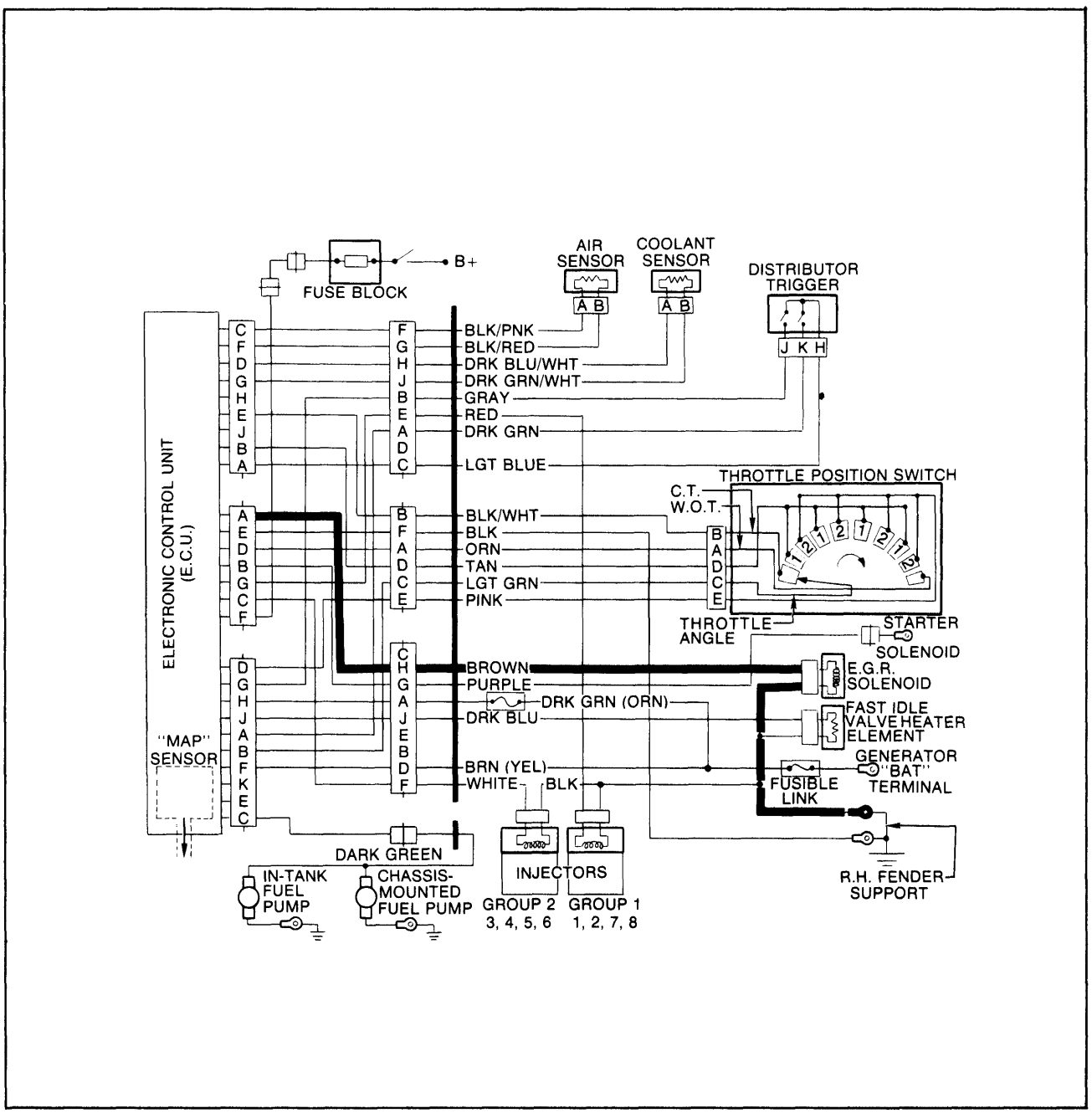


Fig. 6-129 Component Testing—Step 6

BACK TO INDEX

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STEP 7. DISTRIBUTOR TRIGGER POINTS

A. Depress Analyzer Switch #7 and crank engine.
B. DISTRIBUTOR TRIGGER POINTS LIGHT 1 AND 11 should **blink alternately.**
   1. If either lamp **fails to light** or **remains on,** replace speed sensor (distributor trigger). In case of car complaint, be sure to check for intermittent operation (malfunction) and lights not blinking on for equal lengths of time. Intermittent operation can be checked in Step 20.
   2. If lights appear OK but engine quits or runs rough with A/C compressor off, replace speed sensor.

STEP 8.

Switch #8 is not used on Cadillac systems.

STEP 9. AIR TEMPERATURE SENSOR

A. Depress Analyzer Switch #9.
   1. If DIGITAL METER reads **between 600 and 1600,** proceed to Step #10. Sensor resistance should also hold to the guidelines shown in Fig. 10.
   2. If DIGITAL METER reads **more than 1600,** proceed to Part "B".
   3. If DIGITAL METER reads **less than 600,** proceed to Part "C."

B. Disconnect Wiring Harness from Air Temperature Sensor and short the two Harness Terminals together.
   1. If DIGITAL METER reads **less than .5,** replace Air Temperature Sensor. Retest after repair.

(NOTE: A poor connection at the sensor connector can also cause a high resistance reading. Inspect connector before replacing sensor.)

   2. If DIGITAL METER reads **more than .5,** inspect black/pink and black/red wires between sensor connector and ECU jumper harness for open circuit, Fig. 11. Repair and retest.

C. Disconnect Wiring Harness from Air Temperature Sensor.
   1. If OPEN CIRCUIT light comes **on,** replace Air Temperature Sensor. Repair and retest.
   2. If OPEN CIRCUIT light remains **off,** inspect black/pink and black/red wires between sensor connector and ECU jumper harness connector for poor connection, Fig. 11. Repair and retest.

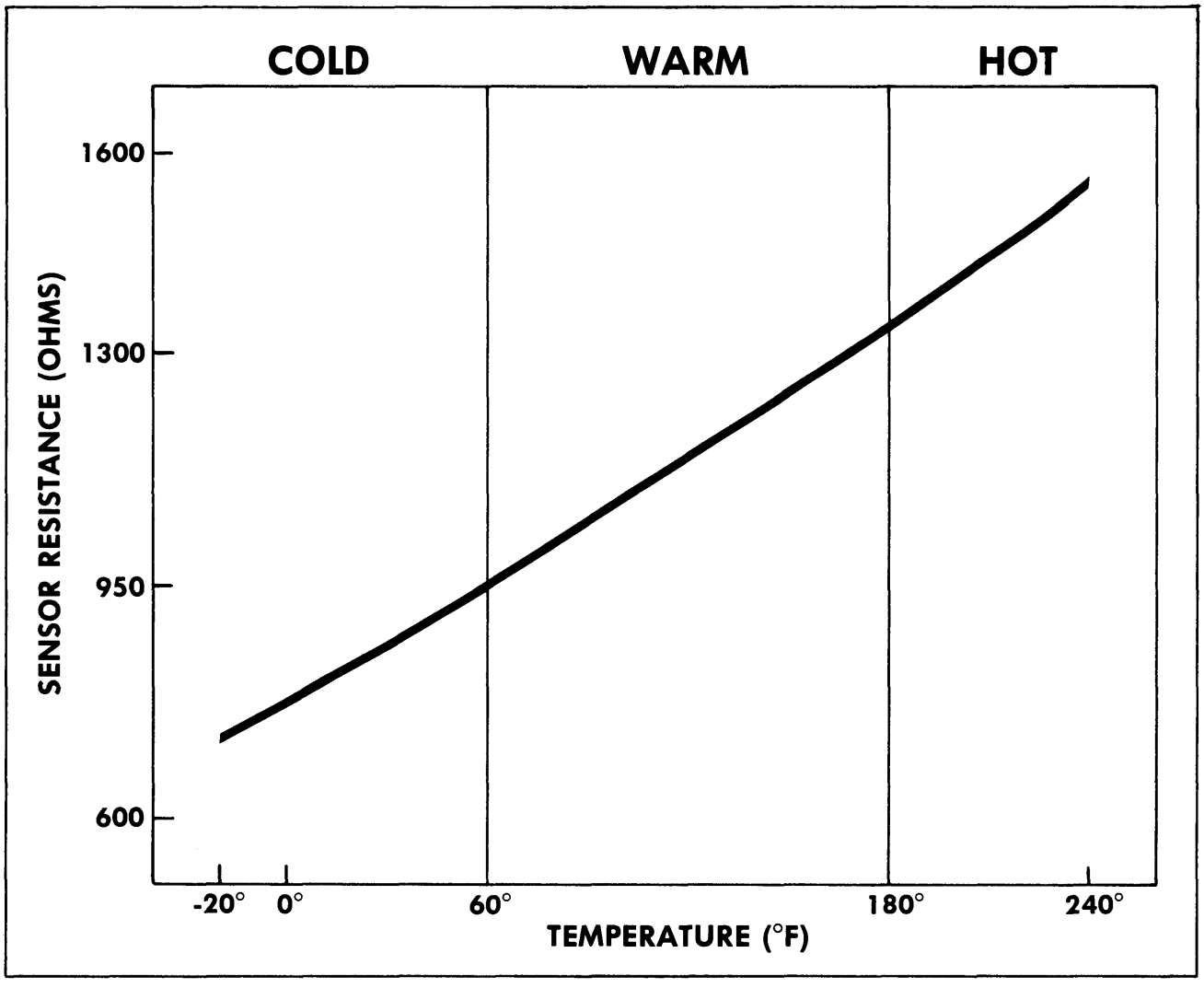


Fig. 6-130 Sensor Resistance Chart

BACK TO INDEX

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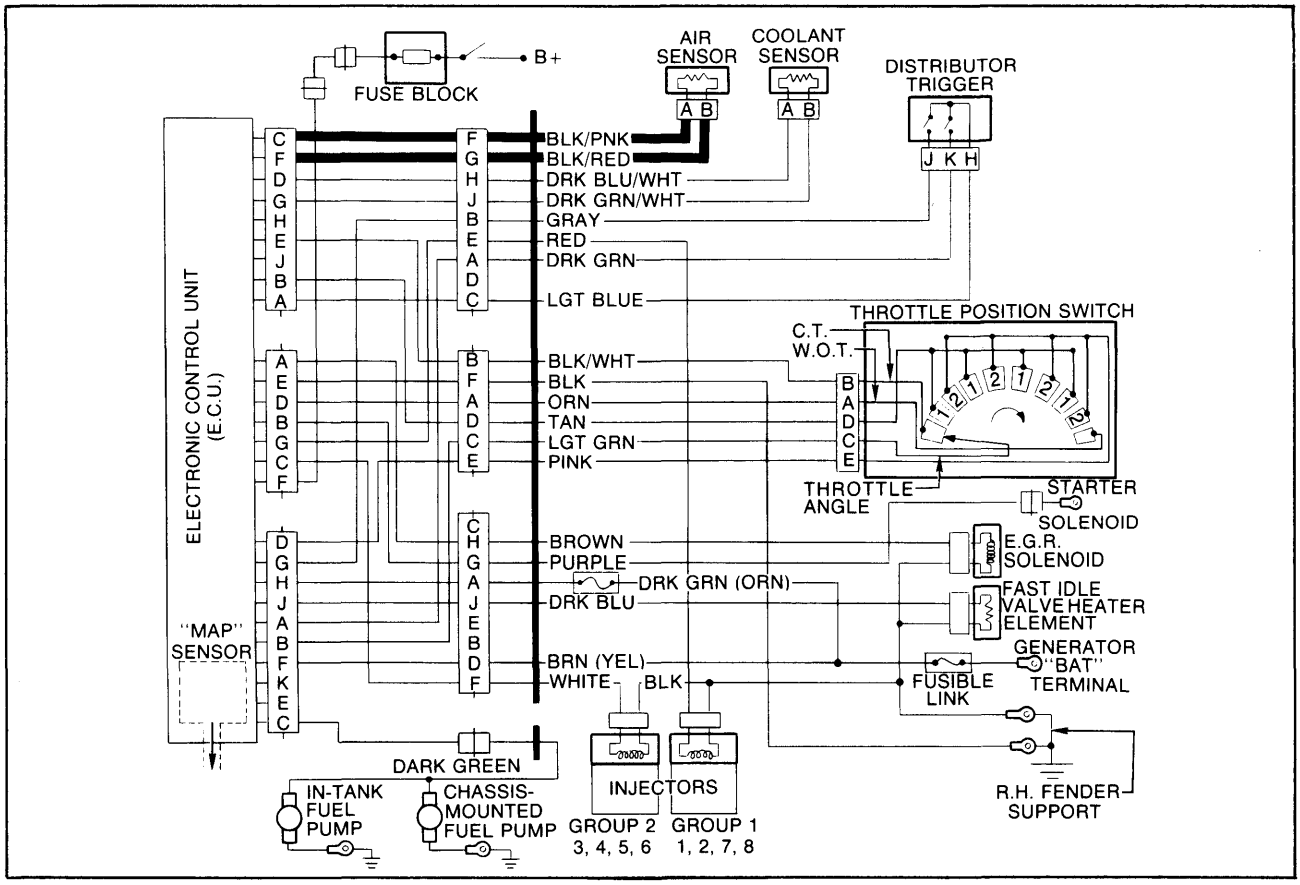


Fig. 6-131 Component Testing—Step 9

BACK TO INDEX

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STEP 10. COOLANT TEMPERATURE SENSOR

A. Depress Analyzer Switch #10.
   1. If DIGITAL METER reads **between 600 and 1600,** proceed to Step #11. Sensor resistance should also hold to the guidelines shown in Fig. 10.
   2. If DIGITAL METER reads **more than 1600,** proceed to Part "B".
   3. If DIGITAL METER reads **less than 600,** proceed to Part "C".

B. Disconnect Wiring Harness from Coolant Temperature Sensor and short the two Harness Terminals together.
   1. If DIGITAL METER reads **less than .5,** replace Coolant Temperature Sensor. Retest after repair.

   (NOTE: A poor connection at the sensor connector can also cause a high resistance reading. Inspect connector before replacing sensor.)

   2. If DIGITAL METER reads **more than .5,** inspect dark blue/white and dark green/white wires between sensor connector and ECU jumper harness for open circuit, Fig. 12. Repair and retest.

C. Disconnect Wiring Harness from Coolant Temperature Sensor.
   1. If OPEN CIRCUIT light comes **on,** replace Coolant Temperature Sensor. Repair and retest.
   2. If OPEN CIRCUIT light remains **off,** inspect dark blue/white and dark green/white wires between sensor connector and ECU jumper harness connector for poor connection, Fig. 12. Repair and retest.

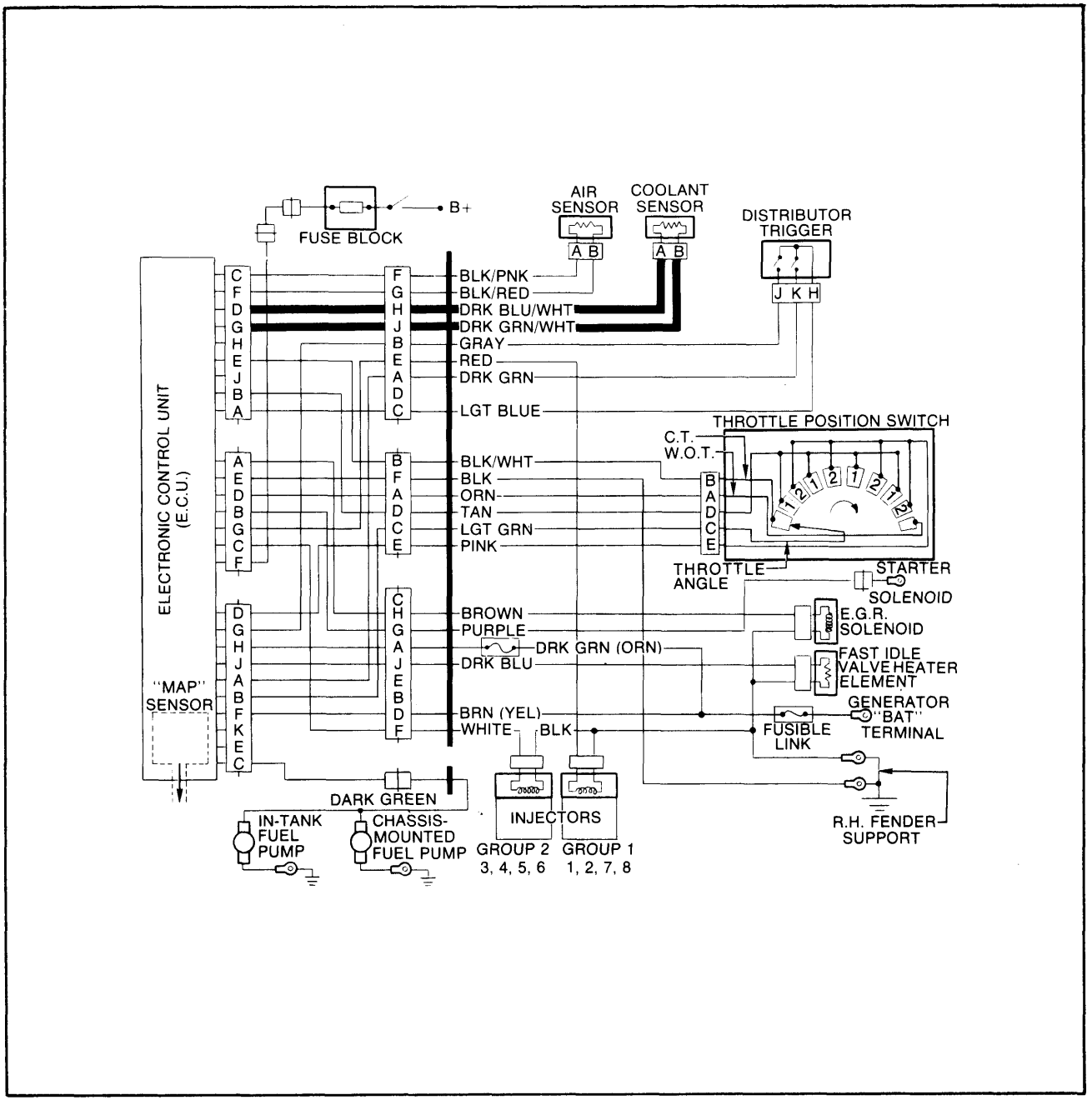


Fig. 6-132 Component Testing—Step 10

BACK TO INDEX

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STEP 11. CLOSED THROTTLE SWITCH

A. Depress Analyzer Switch #11 and observe THROTTLE SWITCH lights.
B. With throttle closed, CLOSED light should be **on** and OPEN light should be **off.**
C. If lights operate properly, proceed to Part "D".
   1. If CLOSED light is **off,** check to see that throttle is closing fully (linkage, shaft, etc.).
   2. Connect a jumper between black/white and light green wires at Throttle Position Switch connector, Fig. 13.
      a. If CLOSED LIGHT is now **on;**
         1. Check Throttle Position Switch adjustment.
         2. If adjustment is OK, replace switch.
         3. Repair and retest.
      b. If CLOSED light did not come on;
         1. Inspect black/white and light green wires between Throttle Position Switch connector and ECU jumper harness for open circuit or poor connection, Fig. 13.
         2. Repair and retest.
D. Open throttle slightly and observe THROTTLE SWITCH lights.
E. CLOSED light should be **off** and OPEN light should be **on.**
   1. If lights operate properly, proceed to Part "F".
   2. If OPEN light remains **off:**
      a. Disconnect connector at Throttle Position Switch.
      b. If OPEN light comes **on;**
         1. Check adjustment of Throttle Position Switch.
         2. If adjustment is OK, replace switch.
         3. Repair and retest.
      c. If OPEN light remains **off,** inspect black/white and light green wires between Throttle Position Switch connector and ECU jumper harness for short circuit, Fig. 13. Repair and retest.
F. Slowly close throttle and observe THROTTLE SWITCH lights.
G. CLOSED light should be **on** and OPEN light should be **off.**

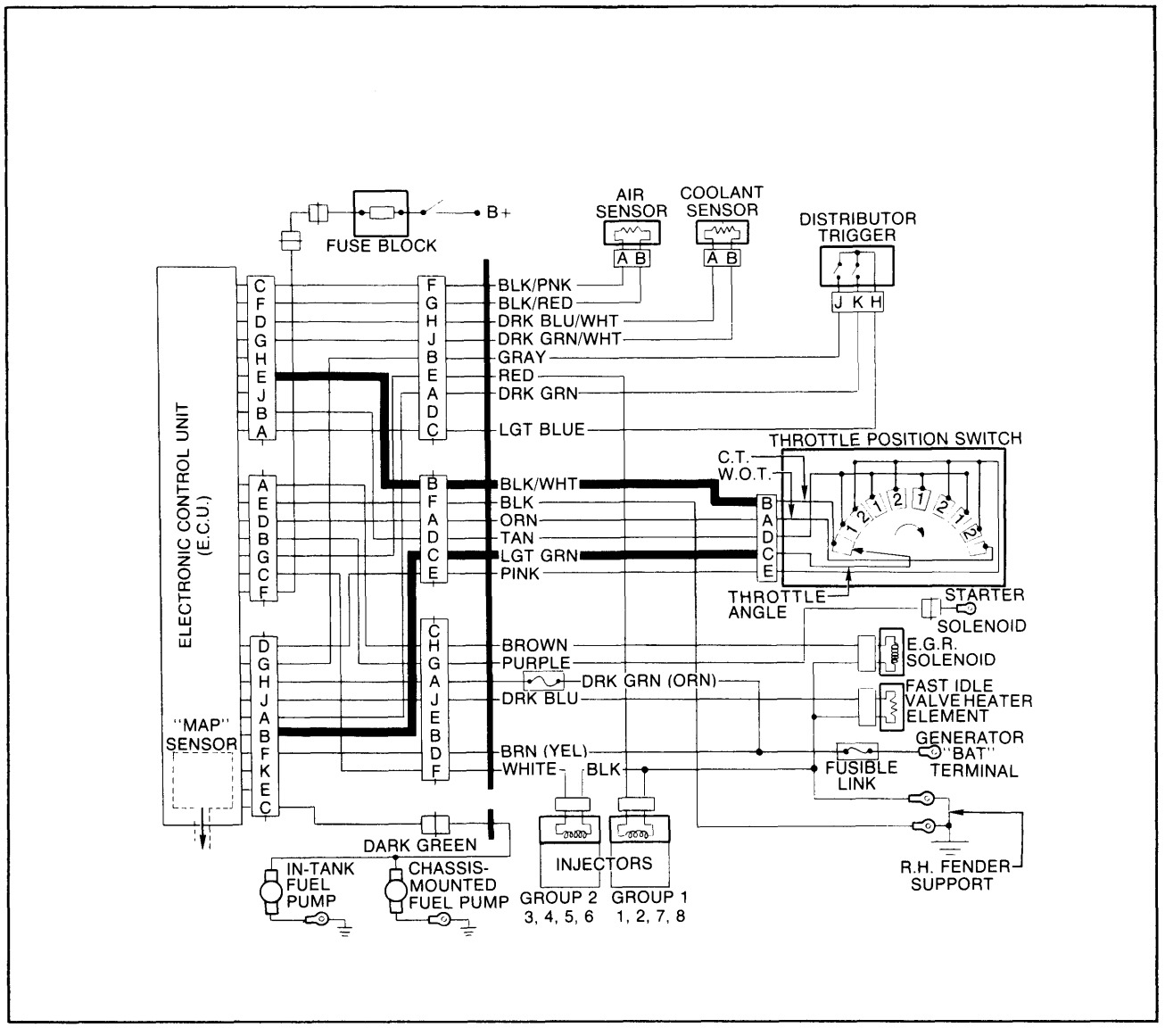


Fig. 6-133 Component Testing—Step 11

BACK TO INDEX

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STEP 12. WIDE OPEN THROTTLE SWITCH

A. Depress Analyzer Switch #12 and observe THROTTLE SWITCH lights.

B. With throttle closed, CLOSED light should be **off** and OPEN light should be **on.**
   1. If lights operate properly, go to Part "C".
   2. If CLOSED light is **on,** disconnect Throttle Position Switch connector.
      a. If light **goes out,** replace Throttle Position switch. Repair and retest.
      b. If light is **still on,** inspect orange and light green wires between Throttle Position Switch connector and ECU jumper harness for short circuit. Repair and retest.

C. With throttle held wide open, CLOSED light should be **on** and OPEN light should be **off.**
   1. If lights operate properly, proceed to Step 13.
   2. If CLOSED light is **off,** connect a jumper between the orange and light green wires at the Throttle Position Switch connector, Fig. 14.
      a. If CLOSED light is **on,** check for misadjusted switch and binding or misadjusted linkage. If above checks are OK, replace Throttle Position switch and retest.
      b. If CLOSED light is still **off,** inspect orange and light green wires between Throttle Position Switch connector and ECU jumper harness for poor connection or open circuit, Fig. 14. Repair and retest.

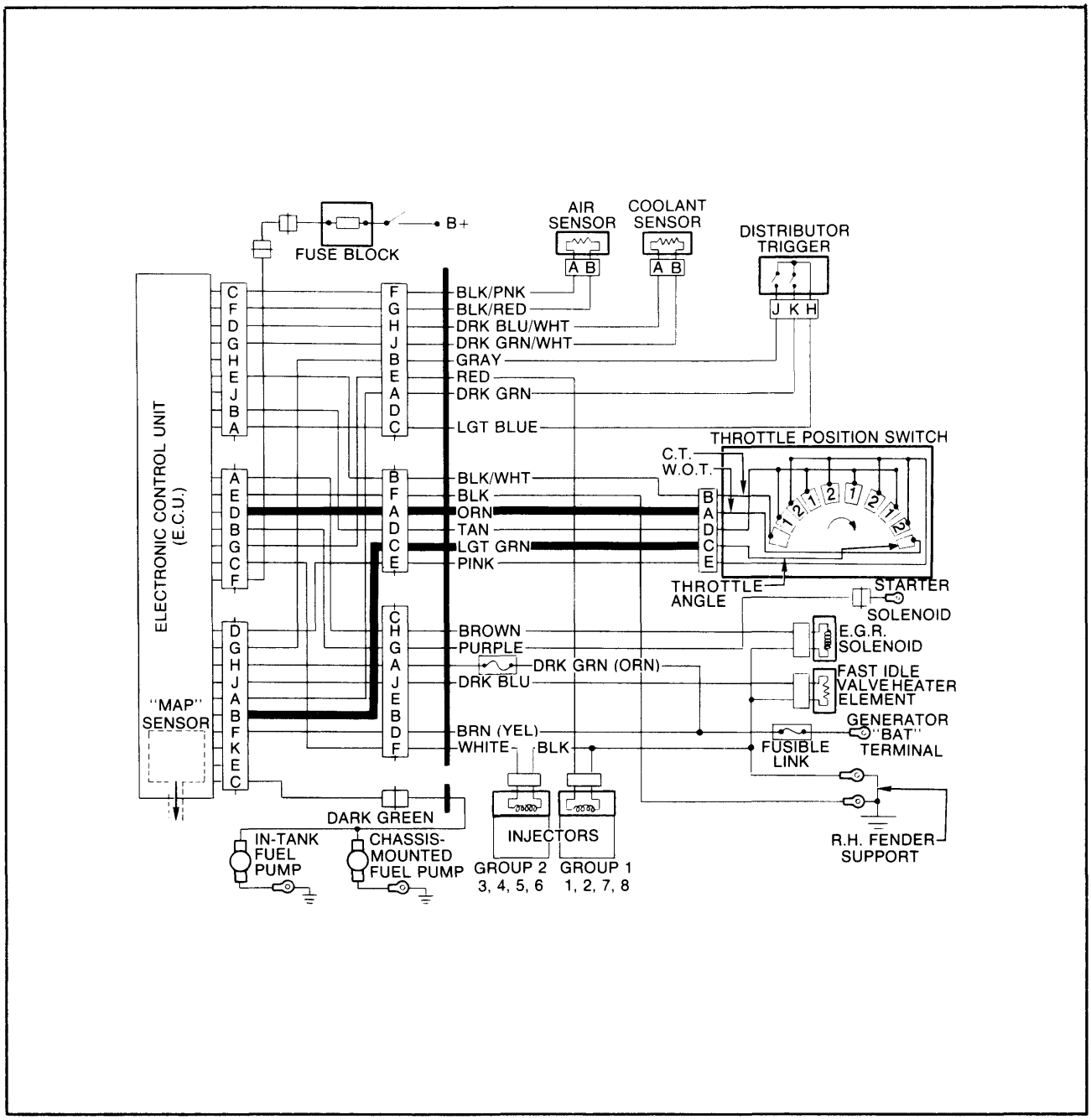


Fig. 6-134 Component Testing—Step 12

BACK TO INDEX

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STEP 13. ACCELERATOR CONTACTS 1

A. Depress Analyzer Switch #13. THROTTLE SWITCH lights will alternately light as throttle is fully depressed. Number of accelerator contact switchings are displayed on the DIGITAL METER. As the throttle is returned to idle, no additional count should be observed. Throttle should be returned slowly to closed throttle position as accelerator pedal bounce might cause an erroneous reading. (''Press to calibrate'' button can be used to zero the digital meter.)

1. If DIGITAL METER reads **10,** proceed to Step 14.
2. If DIGITAL METER reading is **zero,**
   a. Inspect tan and light green wires between Throttle Position Switch connector and ECU jumper harness for open circuit, Fig. 15.
   b. If wiring is OK, replace Throttle Position Switch.
   c. Repair and retest.
3. If DIGITAL METER reading is **not 10** (but greater than zero),
   a. Check Throttle Position Switch adjustment.
   b. If adjustment is OK, replace Throttle Position Switch.
   c. Repair and retest.

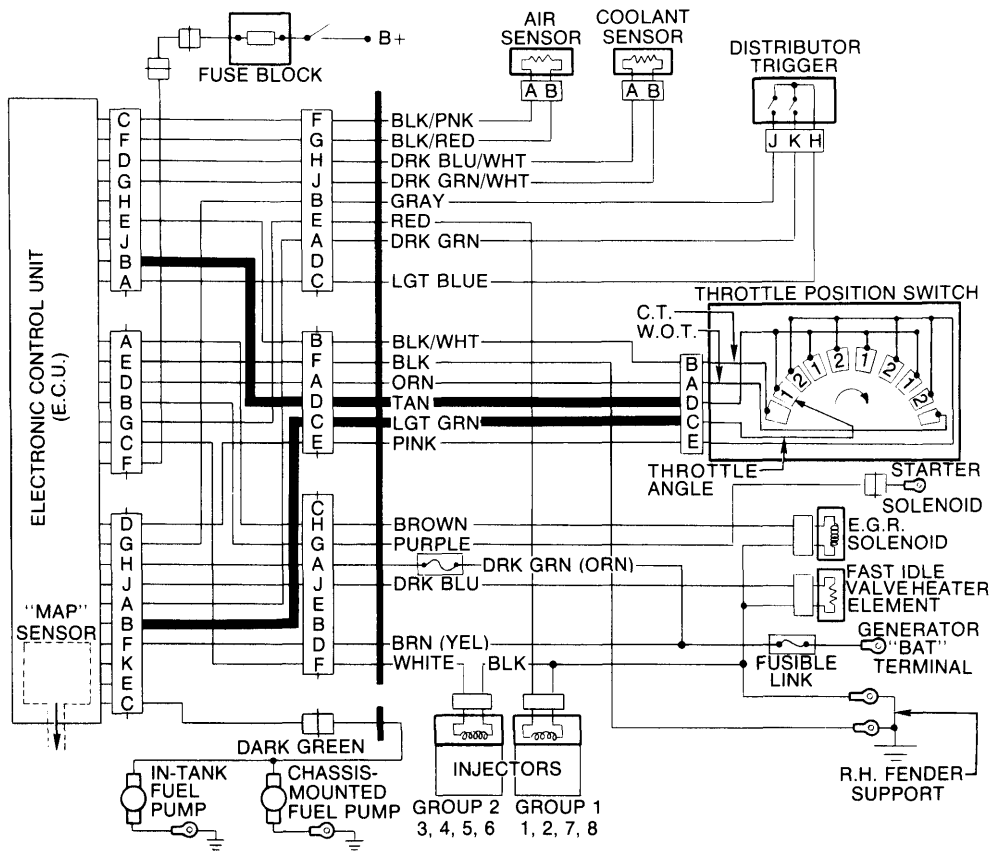


Fig. 6-135 Component Testing—Step 13

BACK TO INDEX

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STEP 14. ACCELERATOR CONTACTS 2

A. Depress analyzer switch #14. THROTTLE SWITCH lights will alternately light as throttle is fully depressed. Number of accelerator contact switchings are displayed on the DIGITAL METER. As the throttle is returned to idle, no additional count should be observed. Throttle should be returned slowly to closed throttle position as accelerator pedal bounce might cause an erroneous reading. (''Press to calibrate'' button can be used to zero the digital meter.)
   1. If DIGITAL METER reads **10,** proceed to Step 17.
   2. If DIGITAL METER reading is **zero,**
      a. Inspect pink and light green wires between Throttle Position Switch connector and ECU jumper harness for open circuit, Fig. 16.
      b. If wiring is OK, replace Throttle Position Switch.
      c. Repair and retest.
   3. If DIGITAL METER reading is **not 10** (but greater than zero),
      a. Check Throttle Position Switch adjustment.
      b. If adjustment is OK, replace Throttle Position Switch.
      c. Repair and retest.

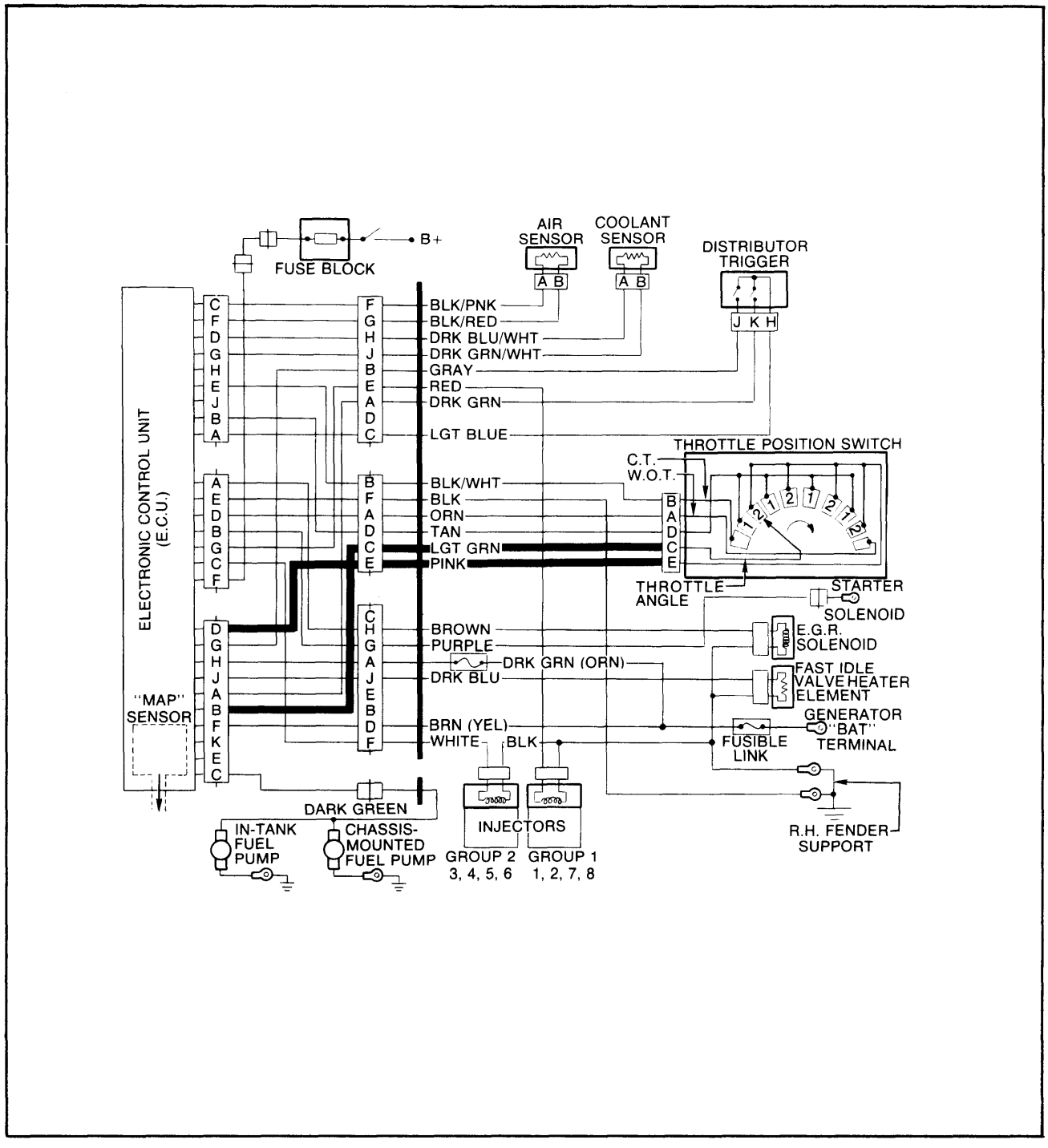


Fig. 6-136 Component Testing Step 14

BACK TO INDEX

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STEP 15
Switch #15 is used on Cadillac systems.

STEP 16
Switch #16 is not used on Cadillac systems.

STEP 17. FUEL SYSTEM
A. Turn Car Ignition **off.**

WARNING: DO NOT LOOSEN FUEL LINE FITTINGS UNTIL THE PRECAUTIONS DESCRIBED BELOW HAVE BEEN TAKEN TO RELIEVE PRESSURE. FUEL IN SYSTEM MAY BE UNDER PRESSURE AND COULD SPRAY OUT AND RESULT IN A FIRE HAZARD AND POSSIBLE PERSONAL INJURY.

B. Fuel in the fuel system may be under pressure and could spray out while connecting test gage. Refer to the appropriate section below to releive this pressure.

1. Without Pressure Relief Fitting
On early production cars without a pressure relief fitting in the rear fuel rail, cover the pressure regulator inlet hose with a shop towel while loosening clamps so that fuel will be absorbed. Dispose of gasoline properly.

2. With Pressure Relief Fitting
Later production cars are equippped with a "Schrader" fitting in the rear fuel rail which makes it unnecessary to relieve fuel pressure to connect the test gage.

C. Insert Pressure Gage J-25400-300 into fuel line by connecting to the "tee" at the pressure regulator or to the relief fitting on the rear fuel rail.

FUEL SYSTEM INTEGRITY
D. Depress Analyzer Switch #17
E. Turn Fuel Pump Switch to **momentary on** position. Check for leaks at pressure gage attachment. Turn Fuel Pump Switch **off.**
1. If fuel pumps operate, go to Part "F".
2. If fuel pumps do not operate, check POWER TO TESTER light.
a. If light is **on** but pumps do not operate, inspect 18 dark green wire between ECU jumper harness and chassis-mounted fuel pump for open circuit (wire should supply 12 volts to pump).
b. If wire is OK, replace chassis-mounted fuel pump.
c. If light is **off,** check 10 amp in-line fuse in car harness and 5 amp fuse in analyzer extender box. Replace blown fuse. If pumps now operate, proceed to Part "F". If fuses are OK but pumps do not operate, replace ECU. If fuse blows consistently, proceed to Step 3.
3. If fuse consistently blows, disconnect 14 dark green wire connector near ECU jumper harness, Fig. 17. Connect a test light or ohmmeter to car side of connector. If short circuit is indicated, proceed as follows:
a. Inspect dark green wire between connector and fuel pumps for cuts or pinched condition. Repair, retest and proceed to Part F.
b. If dark green wire is OK, disconnect dark green wire at chassis-mounted fuel pump and retest at connector for short circuit.
c. If not shorted, replace chassis-mounted fuel pump and proceed to Part F.
d. If still shorted, remove fuel tank and inspect dark green wire between chassis-mounted fuel pump and in-tank fuel pump for cuts or pinched condition. Repair and retest at connector for short circuit. If OK proceed to Part F.

F. If fuel pressure is indicated, proceed to Part G. If fuel pumps operate but no pressure is indicated, proceed as follows:
1. Check fuel level.

(NOTE: Fuel gage float arm may hang-up on in-tank fuel pump resulting in erroneous fuel gage reading.)

2. Pinch off rubber fuel return line at pressure regulator while pumps are actuated.
3. If PRESSURE GAGE reads **over 46 PSI,** replace fuel pressure regulator. Repair, retest and proceed to Part G.
4. If PRESSURE GAGE reads **less than 46 PSI,** disconnect the fuel line at the chassis-mounted fuel pump inlet.

(NOTE: Connect a length of rubber line to the fuel line and position at level higher than the fuel tank to prevent siphoning.)

5. Position a container under the end of the fuel line and turn the analyzer Fuel Pump Switch to the LOCKED ON position.
6. If fuel is not pumped into the container and the fuel lines are not damaged or obstructed, proceed as follows:
a. Check for open circuit in dark green wire and between ECU and fuel pumps, Fig. 16.
b. If wire is okay, replace in-tank fuel pump.
c. Repair, retest and proceed to Part G.
7. If fuel is pumped into container, reconnect the pump inlet and disconnect the pump outlet. Connect a hose between outlet and container.
8. Turn analyzer Fuel Pump Switch to LOCKED ON position.
9. If no fuel flow is evident, replace chassis-mounted fuel pump. Repair, retest and proceed to Part G.
10. If fuel flow is evident, inspect the fuel line between the chassis-mounted fuel pump and the fuel filter for damage.
11. Replace fuel filter.
12. Repair, retest and proceed to Part G.

G. Turn analyzer Fuel Pump Switch to MOMENTARY ON position. Allow fuel pressure to stabilize and turn Fuel Pump Switch **off.** Observe FUEL PRESSURE gage.
1. **No drop** in fuel pressure indicates a "tight" fuel delivery system. Proceed to Part H.
2. **Drop** in fuel pressure indicates a leak in the fuel system.
a. If fuel pressure decrease **more than 5 PSIG** in 2 minutes, pinch-off rubber fuel return line at fuel Pressure Regulator.
b. If fuel **pressure holds** with the line restricted, replace Pressure Regulator. Repair, retest and proceed to Part H.
c. If fuel **pressure decreases,** restrict fuel delivery

BACK TO INDEX
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line by pinching-off rubber fuel line at fuel filter inlet.

d. If fuel **pressure holds** with line restricted, replace chassis-mounted fuel pump. Repair, retest and proceed to Part H.

e. If **pressure decreases,** leave clamp on fuel pump line and install a second clamp at the rubber fuel return line at the fuel Pressure Regulator.

f. If fuel **pressure decreases,** remove fuel rails and inspect each intake port for fuel accumulation or excessively wet walls. Replace injector if this condition is observed. Remove accumulated fuel from cylinder(s). Repair, retest and proceed to Part H.

PRESSURE REGULATOR TEST

H. If fuel pumps operate properly, proceed as follows:

1. Disconnect vacuum hose from Pressure Regulator and connect Vacuum Pump J-23738 or equivalent to Fuel Pressure Regulator.
2. Turn analyzer Fuel Pump Switch to **locked on** position.
3. Fuel pressure should be **37.5 to 41 PSIG with O"HG;** if within specification, proceed to Part I.
4. If pressure is **less than 37.5 PSIG,** pinch off rubber fuel return line at Pressure Regular.
   a. If fuel pressure is **41 PSIG or greater,** replace Pressure Regulator.
   b. Repair and proceed to Part I.
   c. If fuel pressure is **less than 41 PSIG,** replace chassis-mounted fuel pump.
   d. Repair, retest and proceed to Part I.
5. If pressure is **greater than 41 PSIG,** disconnect rubber fuel return line from Pressure Regulator and position a container under the outlet fitting on the regulator. Turn the analyzer Fuel Pump Switch to the MOMENTARY ON position.
   a. If pressure is **greater than 41 PSIG,** replace the Fuel Pressure Regulator. Repair, retest and proceed to Part I.
   b. If fuel pressure is **37.5-41 PSIG,** inspect fuel return line for damage. Repair, retest and proceed to Part I.

I. Observe the FUEL PRESSURE GAGE while applying vacuum to the pressure regulator. The following readings should be observed:

Vacuum	Fuel Pressure
0" Hg.	36.75-41.75 P.S.I. GAUGE
5" Hg.	34.25-39.25 P.S.I. GAUGE
10" Hg.	32.0 -36.75 P.S.I. GAUGE
15" Hg.	29.5 -34.0 P.S.I. GAUGE
20" Hg.	27.0 -31.75 P.S.I. GAUGE

1. If values cannot be obtained, replace Pressure Regulator.
2. Repair, retest and proceed to Part J.
3. Turn analyzer Fuel Pump Switch **off.**
4. Remove vacuum pump J-23738 and connect car vacuum hose to pressure regulator.

INJECTOR TEST

J. Turn Injector Selector Knob on analyzer to **"1".** Group 1 injectors (1, 2, 7 and 8) are tested in this position.

1. Disconnect electrical connector at injectors 2, 7 and 8. This isolates injector number 1.
2. Turn analyzer Fuel Pump Swith to MOMENTARY ON position allowing fuel pressure to stabilize.
3. Depress analyzer Push-To-Inject switch TWICE, and record pressure drop. (Number of injector pulses (20) will be displayed on DIGITAL METER.)
4. Disconnect injector number 1 and connect injector number 2. This isolates injector number 2.
5. Repeat Parts "2", "3" and "4" for each injector in group.
6. Each injector should **drop 2-5 PSIG** and the pressure drop from each injector should be **within 1 PSI of the other 7 injectors.** Replace injector if out of specification. Repair, retest and proceed to Part K.

K. Turn Injector Selector Knob on analyzer to **"2".** Group 2 injectors (3, 4, 5 and 6) are tested in this position.

1. Disconnect electrical connector at injectors 4, 5 and 6. This isolates injector number 3.
2. Turn analyzer Fuel Pump Switch to MOMENTARY ON position allowing fuel pressure to stabilize.
3. Depress analyzer Push To Inject switch TWICE and record pressure drop. (Number of injector pulses (20) will be displayed on DIGITAL METER.)
4. Disconnect injector number 3 and connect injector number 4. This isolates injector number 4.
5. Repeat parts "2", "3" and "4" for each injector in group.
6. Each injector should **drop 2-5 PSIG** and the pressure drop from each injector should be **within 1 PSI** of the other 7 injectors. Replace injector if out of specification. Repair and retest.
7. Crank engine to exhaust excess fuel accumulated in test.
8. Remove Fuel Pressure Gage and install relief fitting cover on cars so equipped.

WARNING: DO NO LOOSEN FITTINGS UNTIL THE PRECAUTIONS DESCRIBED BELOW HAVE BEEN TAKEN TO RELIEVE PRESSURE. FUEL IN SYSTEM MAY BE UNDER PRESSURE AND COULD SPRAY OUT AND RESULT IN A FIRE HAZARD AND POSSIBLE PERSONAL INJURY.

a. Without pressure fitting

Cars without a pressure fitting in the fuel rail, cover the fitting to be removed with a shop towel while loosening so that fuel will be absorbed. Dispose of gasoline properly.

b. With pressure fitting

On cars equipped with a "Schrader" fitting in the fuel rail, remove pressure gage by unscrewing adapter from fuel rail fitting. Replace cap.

BACK TO INDEX

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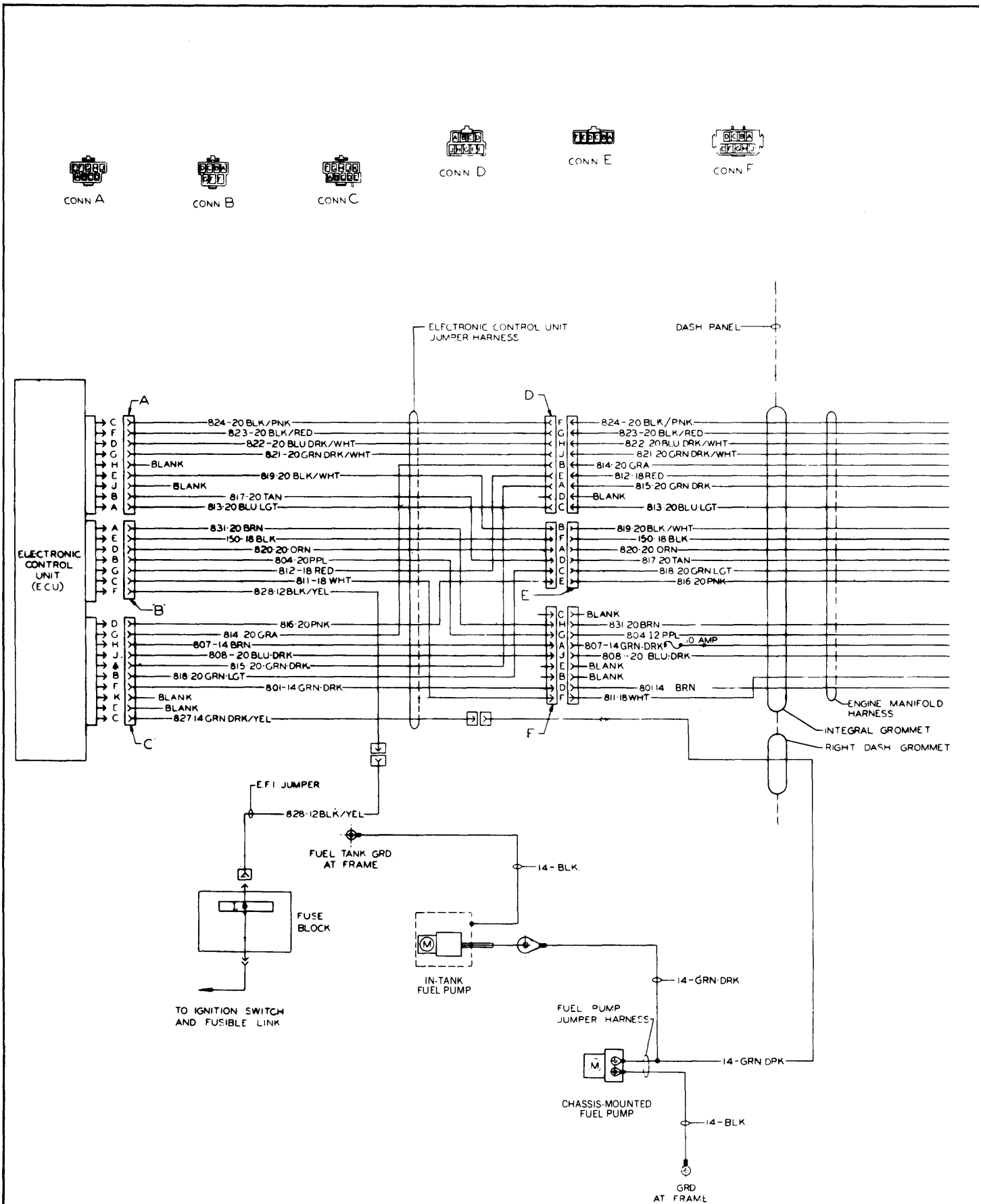


Fig. 6-137 Circuit Diagram

BACK TO INDEX

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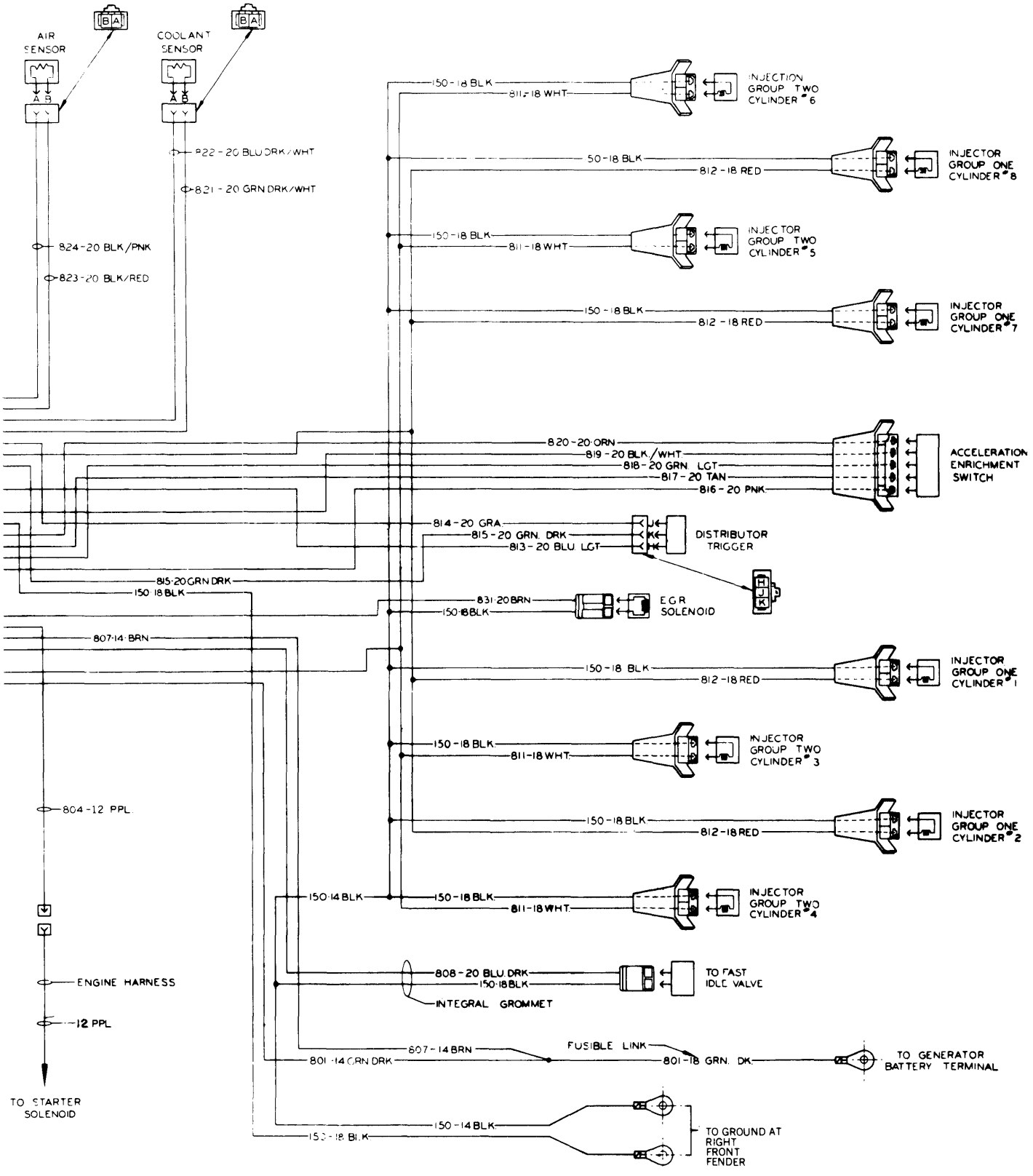


Fig. 6-137 Circuit Diagram

BACK TO INDEX

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STEP 18. SUBSTITUTE ECU

This step connects the car to a portion of the analyzer which contains a "skeleton" ECU. This provides manual control of pulse width to allow the car to be driven short distances in the event of problems in the ECU, connectors or ECU jumper harness which prevent the car from starting. Pulse width (fuel flow) is controlled manually by the INJECTION DURATION knob on the analyzer and must be changed as throttle opening changes. There are no automatic functions or compensations in this control unit.

A. Depress analyzer Switch #18.
B. Adjust INJECTION DURATION knob to 5-8.
C. Push ENRICHMENT SWITCH on extender box to **locked on** position.
D. Turn analyzer Fuel Pump Switch to **locked on** position.
E. Depress accelerator **twice** to inject fuel for initial start-up.
F. Start engine adjusting INJECTION DURATION knob to the smoothest running position.

CAUTION: Should not have to exceed injection duration setting of 8 during this test.

G. Turn SYSTEM MONITOR knob to **pulse width** to observe injector pulse duration readings on DIGITAL METER.
H. When finished, turn Car Ignition Switch **off.**
I. Turn analyzer Fuel Pump Switch **off.**
J. Turn ENRICHMENT SWITCH on extender box to **off** position.

STEP 19. ECU FUNCATIONAL TEST

This test is a check of the ECU and ECU jumper harness only. Engine sensor signals, produced within the analyzer, are sent to the ECU. The ECU response to these signals are read on the analyzer DIGITAL METER.

A. Depress analyzer Switch #19.

(NOTE: OPEN CIRCUIT light will be on during this step.)

B. Turn car Ignition Switch **off.**
C. Connect the ECU Jumper Harness Connectors to the Analyzer Extender Harness as shown in Fig. 2 (marked by *).

CAUTION: Do not connect the ECU harness to the fuel pump lead (dark green/yellow wire) at this time. Analyzer fuel pump light should be off during this test.

D. Turn car Ignition Switch **on.**
   1. Observe analyzer injector GROUP 1 AND GROUP 2 lights **blinking.**
      a. If **ok,** proceed to Part 2.
      b. If LIGHTS do **not blink** and complaint was that car would not start, replace ECU.

(NOTE: If car runs properly hot or cold in STEP 20, do **not** replace ECU.)

      c. Repair and retest.
   2. Allow some time for injector pulse width shown on DIGITAL METER to stabilize.
      a. DIGITAL METER should read within the specifications on the appropriate chart on pages 20-22 for your altitude 0" Hg.
      b. If OK, proceed to Step 3.
      c. If DIGITAL METER reads out of specification, at 0" Hg. replace ECU.
      d. Repair and retest.
3. Depress AIR TEMPERATURE SENSOR-COLD switch (simulates 0°F.).
   a. DIGITAL METER should read within specifications on the appropriate chart on pages 20-22 for your altitude.
   b. If OK, proceed to Step 4.
   c. If out of specification replace ECU. Repair and retest.
4. Depress AIR TEMPERATURE SENSOR-WARM switch (simulates 70°F.).
   a. DIGITAL METER should read within specifications on the appropriate chart on pages 20-22 for your altitude.
   b. If OK, proceed to Step 5.
   c. If out of specification, replace ECU. Repair and retest.
5. Depress ENGINE COOLANT TEMPERATURE SENSOR-COLD switch (simulates 0°F.).
   a. DIGITAL METER should read within specifications on the appropriate chart on pages 20-22 for your altitude.
   b. If OK, proceed to Step 6.
   c. If out of specification, replace ECU. Repair and retest.
6. Depress ENGINE COOLANT TEMPERATURE SENSOR-WARM switch (simulates 70°F.).
   a. DIGITAL METER should read within specifications on the appropriate chart on pages 20-22 for your altitude.
   b. If OK, proceed to Step 7.
   c. If out of specification, replace ECU. Repair and retest.
7. Depress ENGINE SPEED LOW switch and allow DIGITAL METER to stabilize (simulates 600 RPM).
   a. DIGITAL METER should respond as shown in appropriate chart on pages 20-22.
   b. If OK, proceed to Step 8.
   c. If out of specification, replace ECU. Repair and retest.
8. Depress ENGINE SPEED HIGH switch (simulates 1700 RPM).
   a. DIGITAL METER should respond as shown in appropriate chart on pages 20-22.
   b. If OK, proceed to Step 9.
   c. If out of specification, replace ECU. Repair and retest.
9. Attach Vacuum Pump J-23738 or equivalent into vacuum hose attached to ECU.
   a. Pump vacuum to values on appropriate chart on pages 20-22 and observe readings on DIGITAL METER for altitude in your area.
   b. If vacuum leakage is observed, check for vacuum leaks at vacuum pump, hoses or connections. If no leakage is found external to the ECU, replace ECU. Repair and retest.
   c. If out of specification, replace ECU.

BACK TO INDEX

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CHART 1 — FEDERAL "C" CAR

VACUUM	SEA LEVEL	500 FT.	1,000 FT.	1,500 FT.	2,000 FT.	2,500 FT.	3,000 FT.	3,500 FT.	4,000 FT.	4,500 FT.	5,000 FT.
0" HG	11.0 TO 17.5	10.4 TO 16.9	9.9 TO 16.3	9.4 TO 15.7	9.2 TO 15.3	9.2 TO 15.3	9.2 TO 15.3	9.2 TO 15.3	9.2 TO 15.3	9.2 TO 15.3	9.2 TO 15.3
5" HG*	6.9 TO 11.9	6.8 TO 11.3	6.6 TO 14.8	6.5 TO 14.2	6.3 TO 13.6	6.2 TO 13.0	6.0 TO 12.5	5.9 TO 11.9	5.7 TO 11.3	5.6 TO 10.8	5.4 TO 10.3
10" HG*	5.4 TO 7.7	5.3 TO 7.5	5.1 TO 9.2	4.9 TO 8.6	4.8 TO 8.0	4.6 TO 7.5	4.5 TO 6.9	4.3 TO 6.5	4.2 TO 6.3	4.1 TO 6.2	3.9 TO 6.0
15" HG*	3.9 TO 6.1	3.7 TO 5.9	3.6 TO 5.7	3.4 TO 5.5	3.3 TO 5.4	3.1 TO 5.2	3.0 TO 5.0	2.8 TO 4.9	4.7 OR LESS	4.6 OR LESS	4.4 OR LESS
20" HG*	4.4 OR LESS	4.3 OR LESS	4.1 OR LESS	3.9 OR LESS	3.8 OR LESS	—	—	—	—	—	—
AIR TEMP. SENSOR — COLD	12.1 TO 21.2	11.5 TO 20.5	10.9 TO 19.7	10.3 TO 19.0	13.3 TO 18.3	12.9 TO 17.6	12.4 TO 16.9	12.0 TO 16.3	11.5 TO 15.6	11.1 TO 14.9	10.7 TO 14.3
— WARM	11.3 TO 19.4	10.7 TO 18.7	10.1 TO 18.0	9.6 TO 17.4	12.4 TO 16.7	12.0 TO 16.1	11.6 TO 15.5	11.2 TO 14.9	10.7 TO 14.3	10.3 TO 13.7	9.9 TO 13.1
COOLANT TEMP. SENSOR — COLD	25.4 TO 53.2	24.0 TO 51.0	22.6 TO 48.8	21.2 TO 46.7	27.4 TO 44.7	26.5 TO 42.7	25.5 TO 40.8	24.6 TO 38.9	23.7 TO 37.1	22.8 TO 35.4	21.9 TO 33.6
— WARM	15.5 TO 31.9	14.7 TO 30.7	13.9 TO 29.5	13.1 TO 28.3	16.9 TO 27.1	16.3 TO 26.0	15.7 TO 24.8	15.2 TO 23.8	14.6 TO 22.7	14.1 TO 21.7	13.5 TO 20.7
ENG. SPEED — LOW	NO CHANGE TO 0.2 DECREASE										
— HIGH	DECREASE 0.1 TO 0.3										

VACUUM	5,500 FT.	6,000 FT.	6,500 FT.	7,000 FT.	7,500 FT.	8,000 FT.	8,500 FT.	9,000 FT.	9,500 FT.	10,000 FT.
0" HG	9.0 TO 15.3	8.5 TO 14.8	8.1 TO 14.3	7.6 TO 13.8	7.2 TO 13.3	6.7 TO 12.8	6.3 TO 12.3	5.9 TO 11.9	5.8 TO 11.4	5.7 TO 10.9
5" HG*	5.3 TO 9.8	5.2 TO 9.2	5.0 TO 8.7	4.9 TO 8.2	4.8 TO 7.7	4.6 TO 7.3	4.5 TO 6.8	4.4 TO 6.5	4.3 TO 6.3	4.2 TO 6.2
10" HG*	3.8 TO 5.9	3.6 TO 5.7	3.5 TO 5.6	3.4 TO 5.4	3.3 TO 5.3	3.1 TO 5.1	3.0 TO 5.0	4.9 OR LESS	4.7 OR LESS	4.6 OR LESS
15" HG*	4.2 OR LESS	4.1 OR LESS	4.0 OR LESS	3.8 OR LESS	3.7 OR LESS	—	—	—	—	—
20" HG*	—	—	—	—	—	—	—	—	—	—
AIR TEMP. SENSOR — COLD	10.2 TO 13.7	9.8 TO 18.6	9.4 TO 17.9	9.0 TO 17.2	8.6 TO 16.5	8.2 TO 15.8	7.8 TO 15.1	7.5 TO 14.4	7.1 TO 13.7	6.7 TO 13.1
— WARM	9.6 TO 12.5	9.2 TO 17.0	8.8 TO 16.4	8.4 TO 15.7	8.0 TO 15.1	7.7 TO 14.4	7.3 TO 13.8	7.0 TO 13.2	6.6 TO 12.6	6.3 TO 12.0
COOLANT TEMP. SENSOR — COLD	21.1 TO 32.0	20.2 TO 42.7	19.4 TO 41.0	18.5 TO 39.4	17.7 TO 37.8	16.9 TO 36.2	16.1 TO 34.6	15.4 TO 33.0	14.6 TO 31.5	13.8 TO 30.0
— WARM	13.0 TO 19.7	12.5 TO 26.5	11.9 TO 25.4	11.4 TO 24.4	10.9 TO 23.4	10.4 TO 22.4	10.0 TO 21.5	9.5 TO 20.5	9.0 TO 19.5	8.5 TO 18.6
ENG. SPEED — LOW	NO CHANGE TO 0.2 DECREASE									
— HIGH	DECREASE 0.1 TO 0.3									

*PULSE WIDTH MUST DECREASE FOR EACH INCREASE IN VACUUM.

BACK TO INDEX

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CHART 2 — FEDERAL "E" CAR, CALIFORNIA "C" CAR

VACUUM	SEA LEVEL	500 FT.	1,000 FT.	1,500 FT.	2,000 FT.	2,500 FT.	3,000 FT.	3,500 FT.	4,000 FT.	4,500 FT.	5,000 FT.
0" HG	10.6 TO 16.6	10.1 TO 16.0	9.6 TO 15.5	9.1 TO 15.1	8.9 TO 15.1	8.9 TO 15.1	8.9 TO 15.1	8.9 TO 15.1	8.9 TO 15.1	8.9 TO 15.1	8.9 TO 15.1
5" HG*	6.8 TO 11.5	6.6 TO 11.0	6.4 TO 14.7	6.3 TO 14.1	6.1 TO 13.6	5.9 TO 13.1	5.8 TO 12.6	5.6 TO 12.1	5.5 TO 11.6	5.3 TO 11.1	5.2 TO 10.6
10" HG*	5.2 TO 7.5	5.0 TO 7.3	4.8 TO 9.6	4.7 TO 9.1	4.5 TO 8.5	4.4 TO 8.0	4.2 TO 7.5	4.0 TO 7.0	3.9 TO 6.5	3.7 TO 6.0	3.6 TO 5.7
15" HG*	3.6 TO 5.8	3.4 TO 5.6	3.2 TO 5.4	3.1 TO 5.2	2.9 TO 5.1	2.8 TO 4.9	4.7 OR LESS	4.5 OR LESS	4.4 OR LESS	4.2 OR LESS	4.0 OR LESS
20" HG*	4.1 OR LESS	3.9 OR LESS	—	—	—	—	—	—	—	—	—
AIR TEMP. SENSOR — COLD	11.6 TO 20.0	11.0 TO 19.3	10.5 TO 18.7	10.0 TO 18.0	13.2 TO 17.4	12.8 TO 16.8	12.4 TO 16.1	12.0 TO 15.5	11.6 TO 14.9	11.3 TO 14.3	10.9 TO 13.7
— WARM	10.8 TO 18.3	10.3 TO 17.7	9.8 TO 17.1	9.3 TO 16.5	12.4 TO 15.9	12.0 TO 15.3	11.6 TO 14.8	11.2 TO 14.2	10.9 TO 13.6	10.5 TO 13.1	10.2 TO 12.6
COOLANT TEMP. SENSOR — COLD	25.8 TO 52.9	24.4 TO 51.0	23.2 TO 49.0	22.1 TO 47.1	29.3 TO 45.2	28.4 TO 43.4	27.5 TO 41.6	26.7 TO 39.9	25.8 TO 38.2	25.0 TO 36.6	24.1 TO 34.9
— WARM	15.5 TO 31.5	14.7 TO 30.4	14.0 TO 29.3	13.3 TO 28.2	17.7 TO 27.1	17.1 TO 26.1	16.6 TO 25.0	16.1 TO 24.0	15.5 TO 23.0	15.0 TO 22.0	14.5 TO 21.1
ENG. SPEED — LOW	DECREASE 0.2 TO 0.3										
— HIGH	± 0.1 OR NO CHANGE										

VACUUM	5,500 FT.	6,000 FT.	6,500 FT.	7,000 FT.	7,500 FT.	8,000 FT.	8,500 FT.	9,000 FT.	9,500 FT.	10,000 FT.
0" HG	8.9 TO 15.1	8.9 TO 14.7	8.5 TO 14.2	8.0 TO 13.8	7.6 TO 13.3	7.2 TO 12.9	6.9 TO 12.5	6.5 TO 12.0	6.1 TO 11.6	5.7 TO 11.2
5" HG*	5.0 TO 10.1	4.9 TO 9.6	4.8 TO 9.2	4.6 TO 8.7	4.5 TO 8.3	4.4 TO 7.8	4.2 TO 7.4	4.1 TO 7.0	4.0 TO 6.5	3.8 TO 6.1
10" HG*	3.5 TO 5.6	3.3 TO 5.4	3.2 TO 5.3	3.0 TO 5.1	2.9 TO 5.0	2.8 TO 4.8	4.6 OR LESS	4.5 OR LESS	4.4 OR LESS	4.3 OR LESS
15" HG*	3.9 OR LESS	3.7 OR LESS	—	—	—	—	—	—	—	—
20" HG*	—	—	—	—	—	—	—	—	—	—
AIR TEMP. SENSOR — COLD	10.5 TO 13.2	10.1 TO 18.4	9.8 TO 17.7	9.4 TO 17.1	9.1 TO 16.4	8.7 TO 15.8	8.4 TO 15.2	8.1 TO 14.5	7.7 TO 13.9	7.4 TO 13.3
— WARM	9.8 TO 12.0	9.5 TO 16.8	9.1 TO 16.2	8.8 TO 15.6	8.5 TO 15.0	8.2 TO 14.4	7.8 TO 13.9	7.5 TO 13.3	7.2 TO 12.7	6.9 TO 12.2
COOLANT TEMP. SENSOR — COLD	23.3 TO 33.4	22.5 TO 45.6	21.7 TO 43.9	20.9 TO 42.3	20.1 TO 40.7	19.4 TO 39.1	18.6 TO 37.5	17.9 TO 36.0	17.1 TO 34.5	16.4 TO 33.0
— WARM	14.0 TO 20.2	13.6 TO 27.8	13.1 TO 26.7	12.6 TO 25.8	12.1 TO 24.8	11.7 TO 23.8	11.2 TO 22.9	10.8 TO 21.9	10.3 TO 20.4	9.9 TO 20.1
ENG. SPEED — LOW	DECREASE 0.2 TO 0.3									
— HIGH	± 0.1 OR NO CHANGE									

*PULSE WIDTH MUST DECREASE FOR EACH INCREASE IN VACUUM.

BACK TO INDEX

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CHART 3 — CALIFORNIA "E" CAR

VACUUM	SEA LEVEL	500 FT.	1,000 FT.	1,500 FT.	2,000 FT.	2,500 FT.	3,000 FT.	3,500 FT.	4,000 FT.	4,500 FT.	5,000 FT.
0" HG	10.5 TO 16.5	10.0 TO 16.0	9.5 TO 15.4	9.0 TO 15.1	8.8 TO 15.1	8.8 TO 15.1	8.8 TO 15.1	8.8 TO 15.1	8.8 TO 15.1	8.8 TO 15.1	8.8 TO 15.1
5" HG*	6.6 TO 11.4	6.5 TO 10.9	6.3 TO 14.6	6.1 TO 14.1	6.0 TO 13.6	5.8 TO 13.1	5.7 TO 12.5	5.5 TO 12.0	5.4 TO 11.5	5.2 TO 11.0	5.1 TO 10.5
10" HG*	5.1 TO 7.3	4.9 TO 7.2	4.7 TO 9.6	4.6 TO 9.0	4.4 TO 8.5	4.2 TO 8.0	4.1 TO 7.5	3.9 TO 6.9	3.8 TO 6.4	3.6 TO 6.0	3.5 TO 5.6
15" HG*	3.5 TO 5.7	3.3 TO 5.5	3.1 TO 5.3	3.0 TO 5.1	2.8 TO 4.9	4.8 OR LESS	4.6 OR LESS	4.4 OR LESS	4.3 OR LESS	4.1 OR LESS	3.9 OR LESS
20" HG*	4.0 OR LESS	—	—	—	—	—	—	—	—	—	—
AIR TEMP. SENSOR — COLD	11.6 TO 20.0	11.0 TO 19.4	10.5 TO 18.7	9.9 TO 18.0	13.3 TO 17.4	12.9 TO 16.8	12.5 TO 16.1	12.1 TO 15.5	11.7 TO 14.9	11.3 TO 14.3	10.9 TO 13.7
— WARM	10.8 TO 18.4	10.3 TO 17.8	9.8 TO 17.1	9.3 TO 16.5	12.4 TO 15.9	12.1 TO 15.4	11.7 TO 14.8	11.3 TO 14.2	10.9 TO 13.7	10.6 TO 13.1	10.2 TO 12.6
COOLANT TEMP. SENSOR — COLD	25.4 TO 52.1	24.2 TO 50.1	23.0 TO 48.0	21.8 TO 46.1	29.2 TO 44.2	28.3 TO 42.3	27.4 TO 40.5	26.5 TO 38.7	25.6 TO 37.0	24.8 TO 35.3	24.0 TO 33.8
— WARM	14.9 TO 30.6	14.2 TO 29.5	13.5 TO 28.3	12.8 TO 27.2	17.2 TO 26.1	16.7 TO 25.1	16.1 TO 24.1	15.6 TO 23.1	15.1 TO 22.1	14.6 TO 21.1	14.1 TO 20.2
ENG. SPEED — LOW	INCREASE 0.3 TO 0.4										
— HIGH	± 0.1 OR NO CHANGE										

VACUUM	5,500 FT.	6,000 FT.	6,500 FT.	7,000 FT.	7,500 FT.	8,000 FT.	8,500 FT.	9,000 FT.	9,500 FT.	10,000 FT.
0" HG	8.8 TO 15.1	8.8 TO 14.7	8.4 TO 14.2	8.0 TO 13.7	7.6 TO 13.3	7.2 TO 12.9	6.8 TO 12.4	6.4 TO 12.0	6.0 TO 11.6	5.7 TO 11.1
5" HG*	4.9 TO 10.1	4.8 TO 9.6	4.7 TO 9.1	4.5 TO 8.7	4.4 TO 8.2	4.2 TO 7.8	4.1 TO 7.3	4.0 TO 6.9	3.9 TO 6.5	3.7 TO 6.1
10" HG*	3.3 TO 5.5	3.2 TO 5.3	3.1 TO 5.1	2.9 TO 5.0	2.8 TO 4.9	4.7 OR LESS	4.6 OR LESS	4.4 OR LESS	4.3 OR LESS	4.1 OR LESS
15" HG*	3.8 OR LESS	—	—	—	—	—	—	—	—	—
20" HG*	—	—	—	—	—	—	—	—	—	—
AIR TEMP. SENSOR — COLD	10.5 TO 13.1	10.2 TO 18.5	9.8 TO 17.8	9.4 TO 17.1	9.1 TO 16.5	8.7 TO 15.8	8.4 TO 15.2	8.1 TO 14.6	7.7 TO 14.0	7.4 TO 13.4
— WARM	9.9 TO 12.0	9.5 TO 16.9	9.2 TO 16.3	8.8 TO 15.7	8.5 TO 15.1	8.2 TO 14.5	7.9 TO 13.9	7.5 TO 13.4	7.2 TO 12.8	6.9 TO 12.2
COOLANT TEMP. SENSOR — COLD	23.1 TO 32.4	22.3 TO 45.5	21.5 TO 43.9	20.7 TO 42.2	20.0 TO 40.6	19.2 TO 39.0	18.4 TO 37.5	17.7 TO 35.9	17.0 TO 34.4	16.2 TO 32.9
— WARM	13.6 TO 19.4	13.1 TO 27.2	12.7 TO 26.2	12.2 TO 25.3	11.8 TO 24.3	11.3 TO 23.3	10.9 TO 22.4	10.4 TO 21.5	10.0 TO 20.6	9.6 TO 19.7
ENG. SPEED — LOW	INCREASE 0.3 TO 0.4									
— HIGH	± 0.1 OR NO CHANGE									

*PULSE WIDTH MUST DECREASE FOR EACH INCREASE IN VACUUM.

BACK TO INDEX

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STEP 20. SYSTEM MONITOR.

This step can be used to check the signals to and from the ECU when operating with the car's own EFI components. It can be used after making other system checks and repairs to assure that EFI components are functioning satisfactorily as part of the car's total EFI system. Also, intermittent conditions can sometimes best be found by operating the vehicle while monitoring the total system.

A. Depress analyzer Switch #20.
B. Connect ECU harness dark green/yellow connector to harness connector (fuel pump lead), Fig. 2.
C. Start car and allow to run at idle. If car will not start, crank the engine while checking the functions described in the following parts 1-7. If required for diagnosis or evaluation of particular conditions, the vehicle may be driven with the analyzer in this monitor mode (switch 20).
   1. POWER TO TESTER light should be **on** to indicate power from the car battery is reaching the ECU jumper harness through the fusible link and yellow (brown) wire. If it is **not on,** go to Step #2, page 4.
   2. IGNITION light should be **on** when the ignition switch is on the "On" or "Start" position to close (turn on) the internal ECU power relay and internal fuel pump power relay. (These relays are not field serviceable.) If it is **not on,** go to Step #2, page 4.
   3. ENGINE CRANK light should be **on** when the ignition switch is in the "Start" position to indicate the crank signal from the starter solenoid is reaching the ECU jumper harness. This signal pulls in the ECU cranking calibration and holds in the fuel pump relay.
      ENGINE CRANK should be **off** when the ignition switch is in the "On" position. If **not,** go to step #2, page 4.
   4. FUEL PUMP light should be **on** and indicates that the dark green/yellow wire from the ECU jumper harness is providing power to the fuel pump body wiring harness. This light does not indicate the pumps are functioning properly. If it is **not on,** go to step #17, page 17.
   5. DISTRIBUTOR TRIGGER POINTS LIGHTS I AND II should be blinking to indicate trigger signals to the ECU from the distributor trigger (speed sensor). For the ECU to pulse the injectors, alternate signals must be received from distributor triggers I and II. If they are **not on,** go to Step #7, page 10.
   6. INJECTOR LIGHTS GROUP I AND II should be **blinking** to indicate ECU pulses to the injectors. If they are **not on,** check Steps #3 and 4, pages 6 and 7.
   7. FAST IDLE VALVE light should be **on** and indicates the ECU jumper harness is supplying power to the dark blue wire going to the fast idle valve. This light does **not** indicate the fast idle valve is functioning properly. If it is **not on,** go to step #5, page 8.
   8. EGR SOLENOID light should be **on** when the engine is **not** warmed up (auto temp. control blower inhibited by engine temp. switch) to indicate ECU jumper harness is supplying power to the brown EGR vacuum shut-off solenoid feed wire. EGR solenoid light should be **off** when engine is warmed up. If light **does not** operate properly, go to step #6, page 9.
D. Check the following EFI system values by rotating the system monitor switch to the appropriate position.
   1. *Battery voltage.* DIGITAL METER should read **greater than 11.5** volts. If not, go to step #2, page 4.
   2. *Air Temperature Sensor.* DIGITAL METER should read **4-6** on a warm engine (70-90°F intake manifold temperature) or **5-7** on a hot engine (over 100°F intake manifold temperature). If not, go to step #9, page 10.
   3. *Engine coolant temperature sensor.* DIGITAL METER should read **4-6** on a warm engine (70-90°F coolant temp), **5-7** on a partially warmed up engine (100-140°F coolant temp) or **6-8** on a hot engine (coolant temp over 180°F). If not, go to Step #10, page 12.

SERVICE INFORMATION

70. Electronic Control Unit (ECU)

a. Removal

1. Disconnect negative battery cable.
2. Remove three climate control outlet grilles – right, left and right center.
3. Working through outlet openings, remove 3 fasteners securing pad to instrument panel support, Fig. 6-138.
4. Remove screws securing pad to instrument panel horizontal support, Fig. 6-138.
5. Pull pad outward and disconnect electrical connector from windshield wiper switch.
6. Remove pad.

(NOTE: To facilitate removal or installation, place shift lever in lo range and on cars equipped with tilt wheel, place wheel in lowest position.)

7. Remove MAP sensor hose, Fig. 6-139.
8. Remove three mounting screws holding ECU in position (one in front, two at side bracket, Fig. 6-139) and remove ECU.
9. Remove electrical connectors (3) from side of ECU.

b. Installation

1. Connect electrical harness to ECU – 3 connectors. Connectors will only fit one way, black towards front of car, blue in center and red towards rear.
2. Position ECU with electrical connectors on right side of car and install three mounting screws, Fig. 6-139.
3. Install MAP sensor hose, Fig. 6-139.
4. Position pad to instrument panel and connect electrical connector for wiper switch.
5. Install screws securing pad to instrument panel horizontal support.
6. Working through climate control outlet openings, install 3 fasteners securing pad to instrument panel support.
7. Install air outlet grilles as described in Section 1, Note
8. Connect negative battery cable.

BACK TO INDEX

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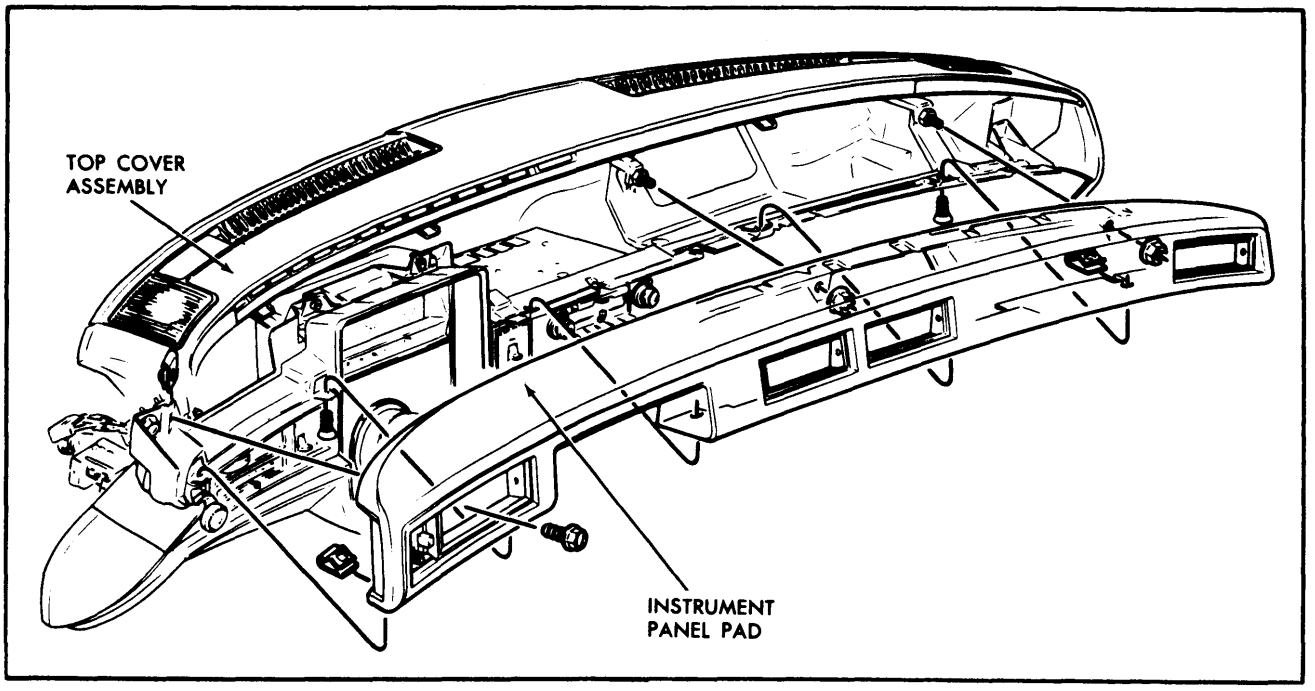


Fig. 6-138 Removing Instrument Panel Pad

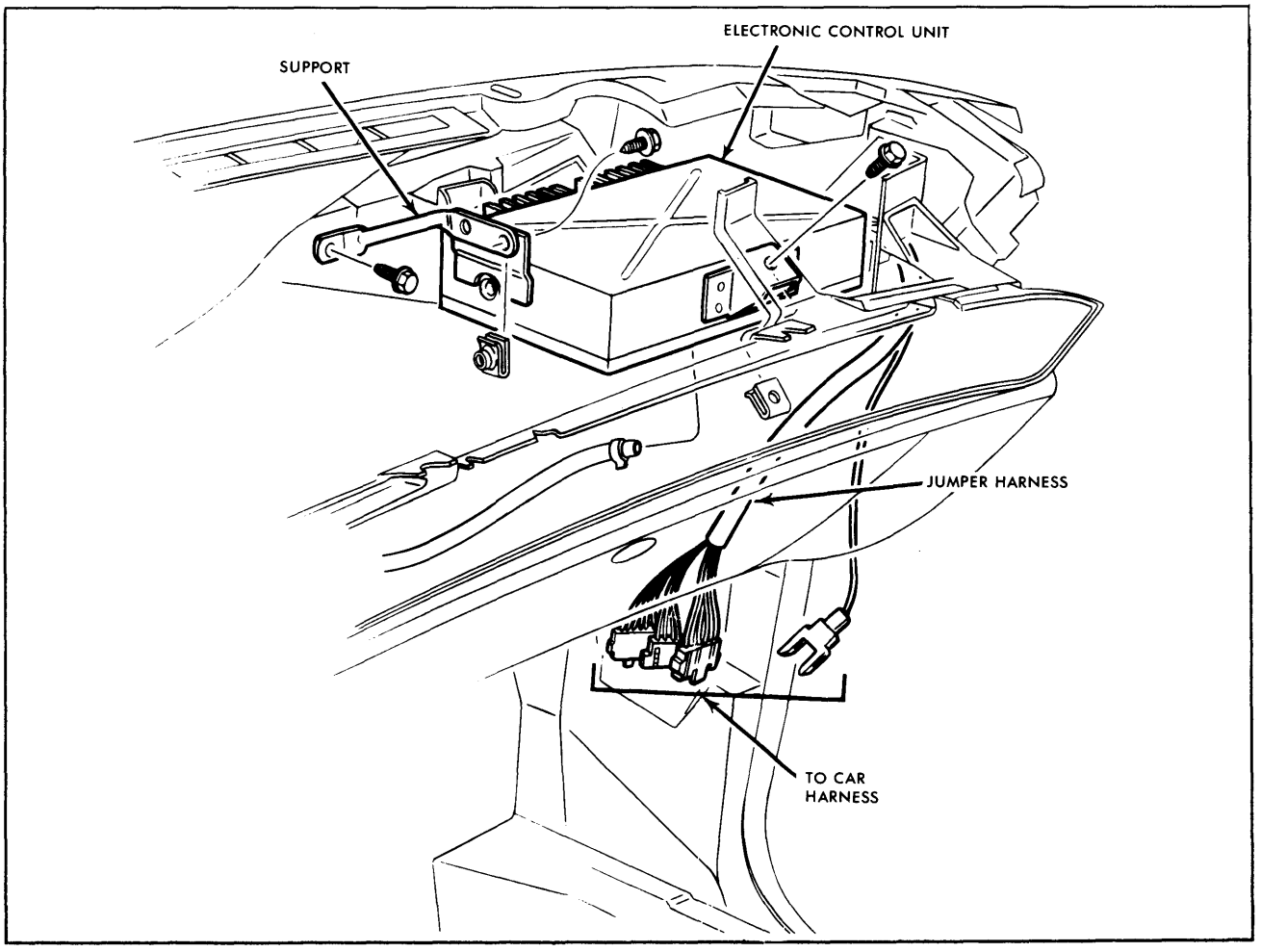


Fig. 6-139 ECU Mounting

BACK TO INDEX

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71. Throttle Body Assembly

a. Removal

1. Remove air cleaner.
2. Disconnect throttle return springs (2) from throttle lever (Fig. 6-153).
3. Remove retainer and remove cruise control chain from throttle lever on cars so equipped, (Fig. 6-154).
4. Remove "hairpin" clip and disconnect throttle cable from throttle lever (Fig. 6-153).
5. Remove left rear throttle body mounting screw and remove one screw holding throttle bracket to intake manifold.
6. Disengage downshift switch from throttle lever and position bracket, switch and linkage out of way.
7. Disconnect throttle position switch electrical connector and fast idle valve electrical connector. Slide fast idle valve wiring out of notch in throttle body.
8. Remove vacuum hoses from nipples on throttle body. Use back-up wrench when removing power brake vacuum line.
9. Remove remaining throttle body mounting screws and remove throttle body, Fig. 6-140.
10. Remove gasket material from intake manifold and bottom of throttle body. Clean all foreign material from area around intake manifold throttle bores.
11. The following parts are not included in a new throttle body assembly and should be removed as necessary:
    a. Throttle position switch (see note 9a).
    b. Fast idle valve seat (see note 10a).
    c. Fast idle valve spring (see note 10a).
    d. Fast idle valve (see note 10a).
    e. Fast idle valve heater assembly (see note 10a).
    f. Power brake vacuum fitting.

b. Installation

1. Position a new throttle body gasket to intake manifold with identification tab on left.
2. Install throttle position switch to right side of throttle body as described in note 10b and adjust switch as described in note 20.
3. Position throttle body to intake manifold and loosely install both front and right rear mounting screws.
4. Move throttle linkage bracket into position over left rear mounting screw and install throttle body mounting screw.
5. Install one additional bracket mounting screw (Fig. 6-153) and torque screws installed in steps 2, 3 and 4 to 15 ft. lbs. Adjust transmission downshift switch as described in section 7, note .
6. Position throttle cable to throttle lever and secure with "hairpin" clip (Fig. 6-153). Check for proper operation and wide-open-throttle.

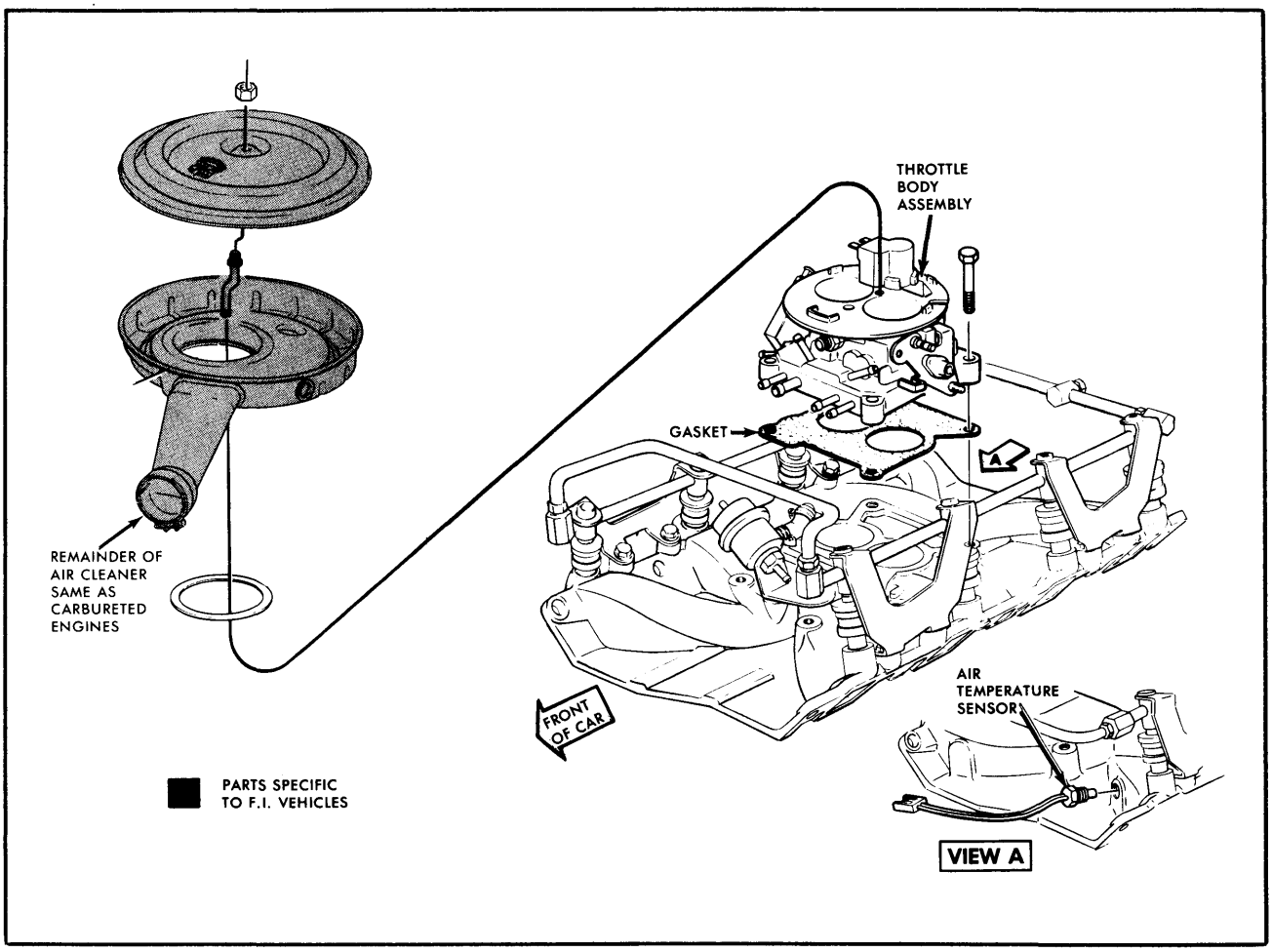


Fig. 6-140 Throttle Body and Air Cleaner

BACK TO INDEX

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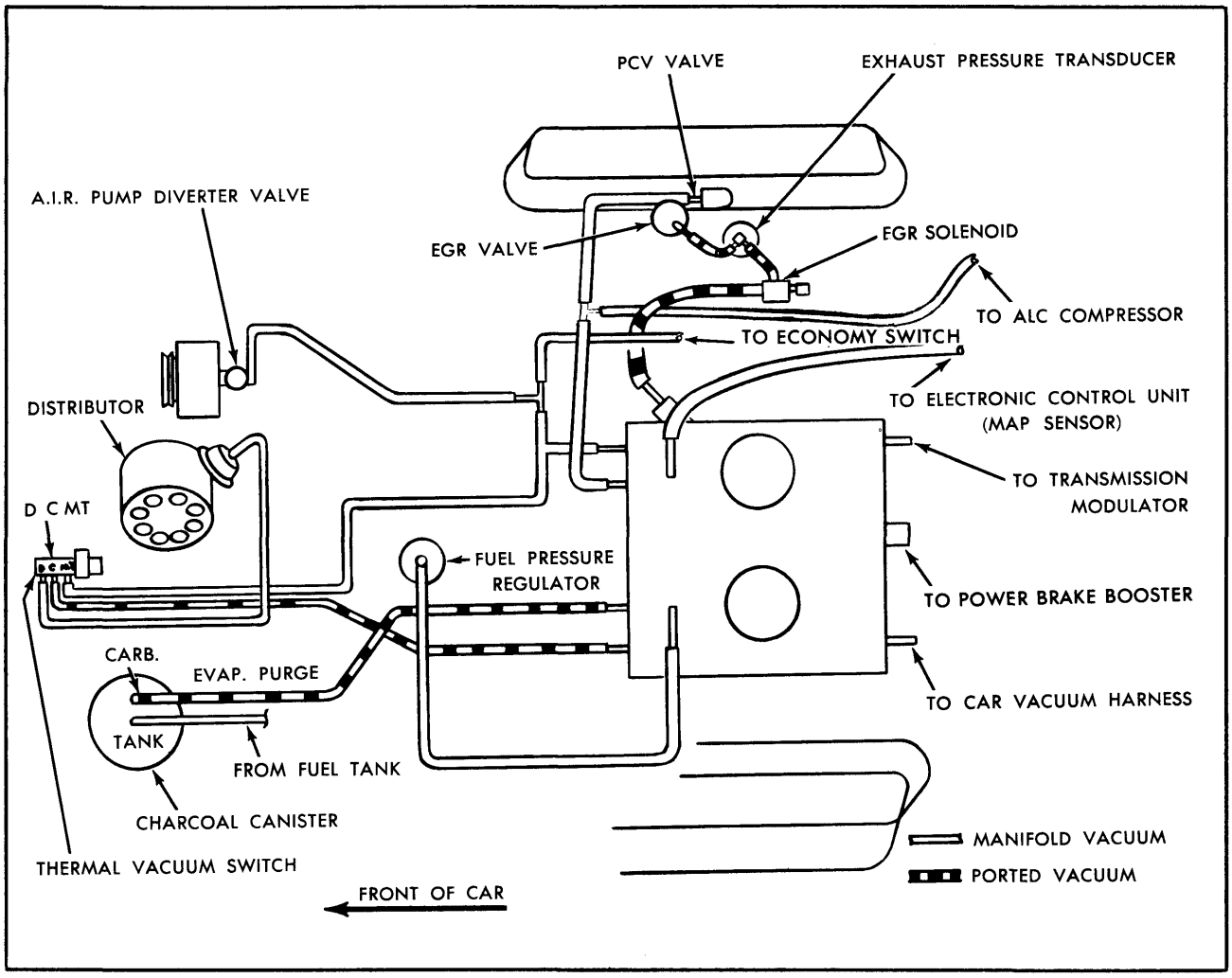


Fig. 6-141 Vacuum Hose Schematic

7. Position cruise control chain to throttle lever and secure with clip on cars so equipped. Check for proper operation.

8. Install power brake vacuum fitting to rear of throttle body and tighten securely. Use back-up wrench.

9. Install throttle return springs (2) between throttle lever and pressure regulator bracket with open end of spring on outside of throttle lever (Fig. 6-153).

10. Install vacuum hoses to appropriate nipples on throttle body as shown in Fig. 6-141. Actual hose routing is shown in Fig. 6-151.

11. Install fast idle valve as described in note 10b.

12. Install air cleaner.

72. Throttle Position Switch

a. Removal

1. Remove throttle body as described in note 8a.

2. Remove two mounting screws and remove switch from throttle body.

b. Installation

1. Install throttle position switch to right side of throttle body so that tab on switch engages flat on throttle shaft, Fig. 6-142.

2. Install two mounting screws and tighten screws so that switch will still move but is not loose.

3. Adjust throttle position switch as described in note 20.

4. Install throttle body as described in note 3b.

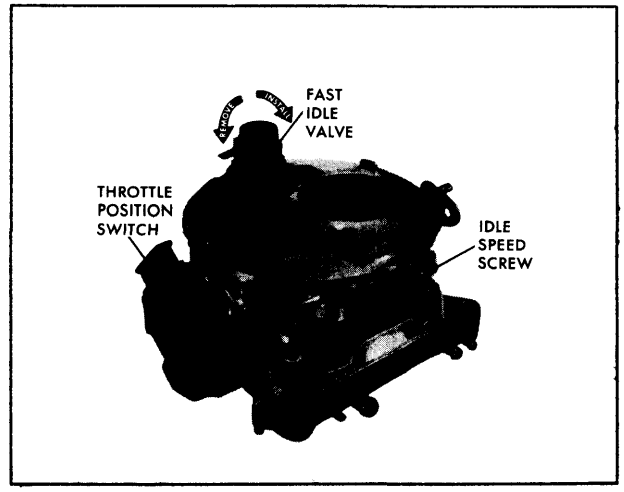


Fig. 6-142 Throttle Body

BACK TO INDEX

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73. Fast Idle Valve

a. Removal

1. Remove air cleaner and disconnect electrical connector from fast idle valve heater.
2. Remove air cleaner stud.
3. To remove fast idle valve heater, push down and twist 90° counter clockwise, Fig. 6-142.
4. Remove fast idle valve, spring and seat from position in throttle body (refer to Fig. 6-115 for parts identification).

b. Installation

1. Install fast idle valve seat, spring and valve in position in throttle body. Refer to Fig. 6-115 for proper arrangement of parts.
2. Position heater on top of fast idle valve and push down to compress spring. Care should be taken to avoid damaging micro-switch contact arm on bottom of heater housing.
3. Align tabs on fast idle valve heater with cut-out portion of throttle body and compress spring further.
4. Rotate heater 90° clockwise to secure in position, Fig. 6-142.
5. Connect electrical connector.
6. Install air cleaner stud and air cleaner.

74. Intake Manifold

a. Removal

1. Disconnect negative battery cable, remove air cleaner and crankcase filter.
2. Disconnect throttle cable and cruise control linkage at throttle body. Remove cable from bracket and position out of way.
3. Working on left side of engine, disconnect coolant temperature tell-tale switch (green wire), HEI lead wire, speed sensor connector, downshift switch and injector wires. Disconnect harness from fuel rail brackets and position harness out of way.
4. Disconnect two vacuum hoses from throttle body to TVS switch.
5. Disconnect vacuum hoses and power brake pipe from rear of throttle body. Use a back-up wrench on power brake fitting.
6. Disconnect fuel line from fuel rail. Use a back-up wrench on fuel rail.

WARNING: DO NOT LOOSEN FITTINGS UNTIL THE PRECAUTIONS DESCRIBED IN NOTE "22" HAVE BEEN TAKEN TO RELIEVE PRESSURE. FUEL IN SYSTEM MAY BE UNDER HIGH PRESSURE WHICH COULD SPRAY OUT AND RESULT IN A FIRE HAZARD AND POSSIBLE PERSONAL INJURY.

7. Working on right side of engine, disconnect injector wires, EGR solenoid leads, throttle position switch, fast idle valve, air temperature sensor connector and MAP sensor hose.
8. Disconnect electrical harness from fuel rail brackets and position out of way.
9. Remove PCV valve from rocker cover and position out of way.
10. Remove spark plug leads and distributor cap.
11. Remove front fuel rail as described in note 9a.
12. Partially remove air conditioning compressor as described in Section 1, note 10a.
13. Remove fuel return hose from pressure regulator.
14. Remove twelve mounting screws and remove manifold. Do not pry against or lift manifold by the fuel rails or their mounting brackets.
15. Remove manifold gaskets.

b. Installation

1. Place rubber intake manifold seals over rails at front and rear of cylinder block. Tabs on gasket should be positioned in holes in rails and beveled ends of gasket tucked into slot at mating of head and rail.
2. Apply gasket sealer to sheet metal gasket-shield on engine. Holes in gasket should engage dowel pins on cylinder heads. Be careful not to use too much sealer near injector tips.
3. Carefully position manifold on cylinder heads by lowering straight down. Secure manifold with twelve screws. Tighten to 30 foot-pounds.
4. Install air conditioning compressor as described in Section 1, note 10b.
5. Install front fuel rail as described in note 14b.
6. Install distributor cap and spark plug leads. Refer to Fig. 6- , for wire routing.
7. Connect fuel return line to pressure regulator using a new hose clamp.
8. Working on right side of engine, secure wiring harness to injector brackets and make the following connections: Red-black injector leads to cylinders 1 and 7; white-black injector leads to cylinders 3 and 5; dark blue/black leads to fast idle valve (install grommet in throttle body); throttle position switch brown-black leads to EGR solenoid and black/pink-black/red lead to air temperature sensor.
9. Connect vacuum hoses to front and rear of throttle body as shown in Fig. 6-141. Actual hose routing is shown in Fig. 6-151.
10. Install PCV valve in rocker cover.
11. Working on left side of engine, secure wiring harness to injector brackets and make the following connections: Red-black injector leads to cylinders 2 and 8; white-black injector leads to cylinders 4 and 6; green wire to coolant tell-tale switch; HEI lead wire and module connector; speed sensor connector (distributor trigger); downshift switch. Refer to Fig. 6-152.
12. Connect fuel line to fuel rail using a back-up wrench on the fuel rail while tightening. Do not use teflon tape on flare nut.
13. Position throttle cable to bracket and secure throttle cable and cruise control cable to throttle body with clips, Fig. 6-153.
14. Connect battery cable.
15. Turn ignition switch ON and OFF several times to build up fuel rail pressure and check for fuel leaks.
16. Start engine, check for leaks and for proper operation.
17. Install air cleaner and crankcase breather.

BACK TO INDEX

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75. Injection Valve

a. Removal

1. Remove front and rear fuel rails as described in note 9, parts a and c.
2. Remove electrical conduit from injector brackets – 4 places each side.
3. Remove two screws holding each injector bracket to intake manifold and remove brackets and grommets.
4. Disconnect electrical lead from all injectors on fuel rail being removed.
5. Remove fuel rail and injectors from engine as a unit. Some injectors will stick in fuel rail while others may remain in manifold.
6. Remove injectors from fuel rail and from intake manifold as required.
7. Injection valves are sealed by O-rings at both fuel rail and intake manifold. Remove and discard all used O-rings.

b. Installation

1. Lubricate and install a new O-ring on the fuel rail end of each injector.
2. Install injectors into fuel rail with electrical connector facing inboard.

(NOTE: Fuel rails are specific for right and left sides of engine.)

3. Lubricate and install a new O-ring into each injector port in the intake manifold.
4. Install fuel rail-injector assembly to intake manifold making sure that each injector is properly installed in manifold O-ring.
5. Install rubber grommets on fuel rail (flange down) and install injector brackets in position.
6. Secure each bracket with two screws. Torque screws to 5 foot-pounds.
7. Route electrical harness along bracket and secure to brackets – 4 positions.
8. Connect injector leads as follows:
   Front cylinder – red/black wires
   Front-center cylinder – black/white wires
   Rear-center cylinder – black/white wires
   rear cylinder – red/black wires

(NOTE: Injectors may be rotated to provide proper harness routing. Refer to Fig. 6-152.)

9. Repeat steps 1 thru 8 for opposite side if necessary.
10. Install front and rear fuel rails as described in note 9b and d.
11. Turn ignition ON and OFF several times to build up fuel rail pressure and check for fuel leaks.
12. Start engine and check for leaks.

(NOTE: A "dry" fuel system on cars equipped with EFI may require a substantial cranking period.)

76. Fuel Pressure Regulator

a. Removal

1. Remove vacuum hose from nipple on top of pressure regulator.

WARNING: DO NOT LOOSEN FITTINGS UNTIL THE PRECAUTIONS DESCRIBED IN NOTE "22" HAVE BEEN TAKEN TO RELIEVE PRESSURE. FUEL IN SYSTEM MAY BE UNDER HIGH PRESSURE WHICH COULD SPRAY OUT AND RESULT IN A FIRE HAZARD AND POSSIBLE PERSONAL INJURY.

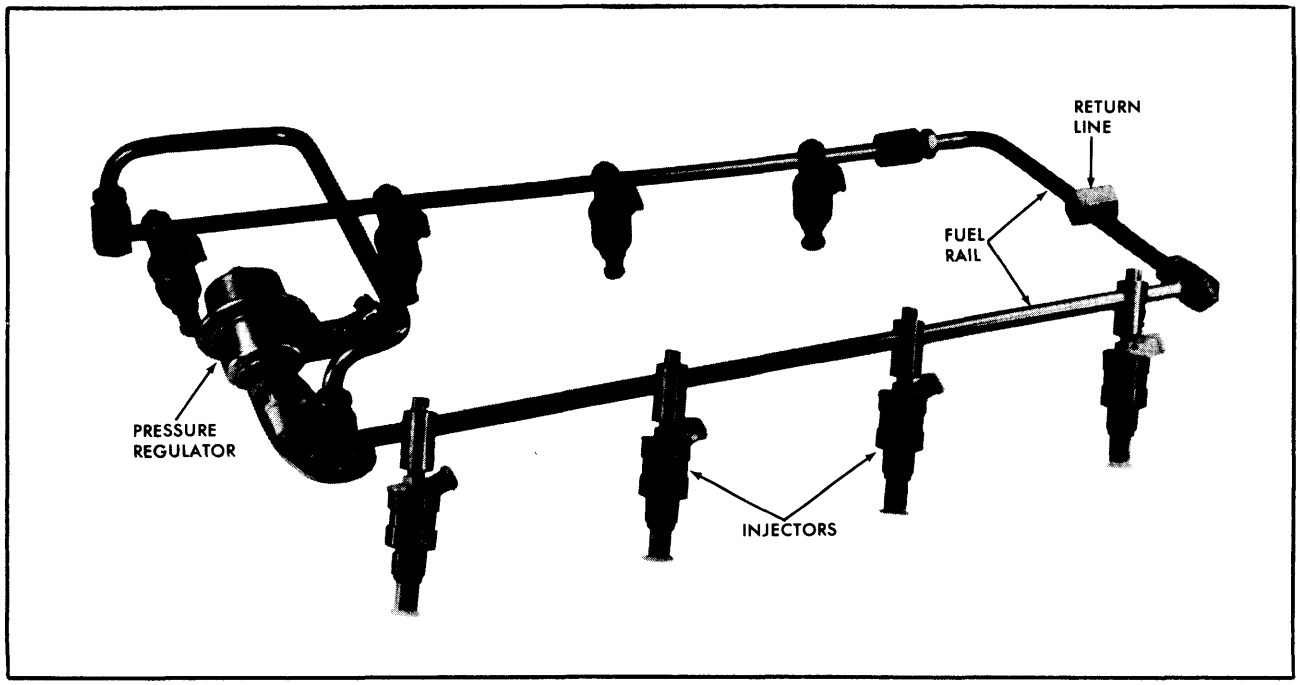


Fig. 6-143 Fuel Rails

BACK TO INDEX

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2. Remove and discard clamps securing flexible fuel hose connecting regulator to fuel rail, Fig. 6-143. Remove return line.

3. Remove one nut securing pressure regulator to bracket, Fig. 6-143.

(NOTE: This nut has metric threads)

4. Work regulator off of flexible fuel hose and out of bracket.

b. Installation

1. Install new hose clamp over flexible fuel hose.

2. Position regulator to bracket and work flexible fuel hose to fuel rail over nipple on side of regulator. Secure to bracket with one nut, Fig. 6-143.

(NOTE: This nut has metric threads. Use the nut supplied with each new regulator or the nut removed in step 3a.)

3. Connect return line to fitting on end of regulator.

4. Tighten clamps, securing flexible fuel hose to regulator, Fig. 6-143.

5. Install vacuum hose to remaining nipple on pressure regulator, Fig. 6-141. Actual hose routing is shown in Fig. 6-151.

6. A "dry" fuel system on cars with EFI may require a substantial cranking period before starting.

77. Fuel Rail

a. Front – Removal

WARNING: DO NOT LOOSEN FITTINGS UNTIL THE PRECAUTIONS DESCRIBED IN NOTE "22" HAVE BEEN TAKEN TO RELIEVE PRESSURE. FUEL IN SYSTEM MAY BE UNDER HIGH PRESSURE WHICH COULD SPRAY OUT AND RESULT IN A FIRE HAZARD AND POSSIBLE PERSONAL INJURY.

1. Remove and discard hose clamp securing pressure regulator hose to front fuel rail.

2. Using a back-up wrench at side rail fitting, remove flare nut from each end of fuel rail.

3. Disengage front rail from pressure regulator hose and remove from vehicle.

b. Front – Installation

1. Install new hose clamp over flexible hose.

2. Position front rail to pressure regulator hose and force hose over nipple.

3. Move rail into position and tighten flare nut into fitting on each side rail to 25-35 foot-pounds. Use a back-up wrench to hold side rail fittings. Do not use teflon tape on flare nuts.

4. Tighten hose clamp securing pressure regulator hose to rail.

5. Turn ignition ON and OFF several times to build up fuel rail pressure and check for fuel leaks.

c. Rear – Removal

WARNING: DO NOT LOOSEN FITTINGS UNTIL THE PRECAUTIONS DESCRIBED IN NOTE "22" HAVE BEEN TAKEN TO RELIEVE PRESSURE. FUEL IN SYSTEM MAY BE UNDER HIGH PRESSURE WHICH COULD SPRAY OUT AND RESULT IN A FIRE HAZARD AND POSSIBLE PERSONAL INJURY.

1. Using a back-up wrench on fuel rail, remove fuel inlet line from rear rail.

2. Using a back-up wrench on fuel rail, remove flare nut at each side rail and remove rear fuel rail.

d. Rear – Installation

1. Position rear fuel rail and thread flare nuts into side rails. Do not use teflon tape on flare nuts.

2. Thread fuel inlet line flare nut into rear rail. Do not use teflon tape on flare nut.

3. Using a back-up wrench on fuel rail, tighten flare nuts to 25-35 foot-pounds.

4. Turn ignition ON and OFF several times to build up fuel rail pressure and check for fuel leaks.

e. Side – Removal

Right or Left side fuel rail removal is the same as injector removal described in note 7.

78. Fuel Filter (Fig. 6-144)

WARNING: DO NOT LOOSEN FITTINGS UNTIL THE PRECAUTIONS DESCRIBED IN NOTE "22" HAVE BEEN TAKEN TO RELIEVE PRESSURE. FUEL IN SYSTEM MAY BE UNDER HIGH PRESSURE WHICH COULD SPRAY OUT AND RESULT IN A FIRE HAZARD AND POSSIBLE PERSONAL INJURY.

The fuel filter element is replaced by unscrewing the bottom cover and removing the filter element. Replace element and gasket with AC type GF 157 or equivalent. Hand tighten bottom cover.

A "Dry" fuel system on cars equipped with EFI may require a substantial cranking period before starting.

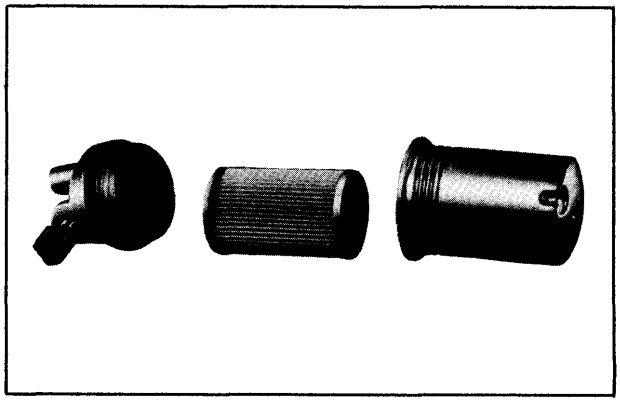


Fig. 6-144 Fuel Filter

BACK TO INDEX

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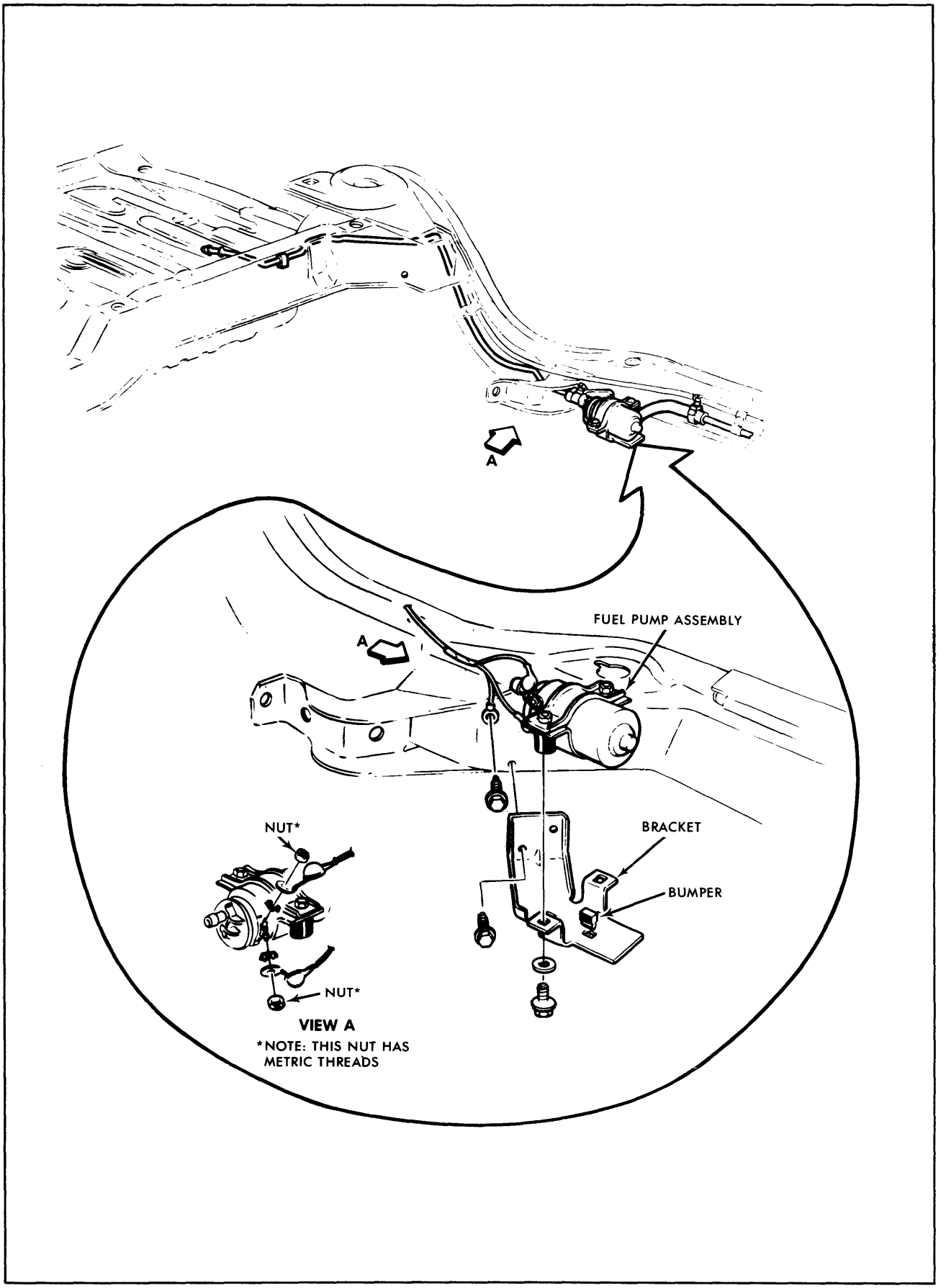


Fig. 6-145 C-Car Fuel Pump

BACK TO INDEX

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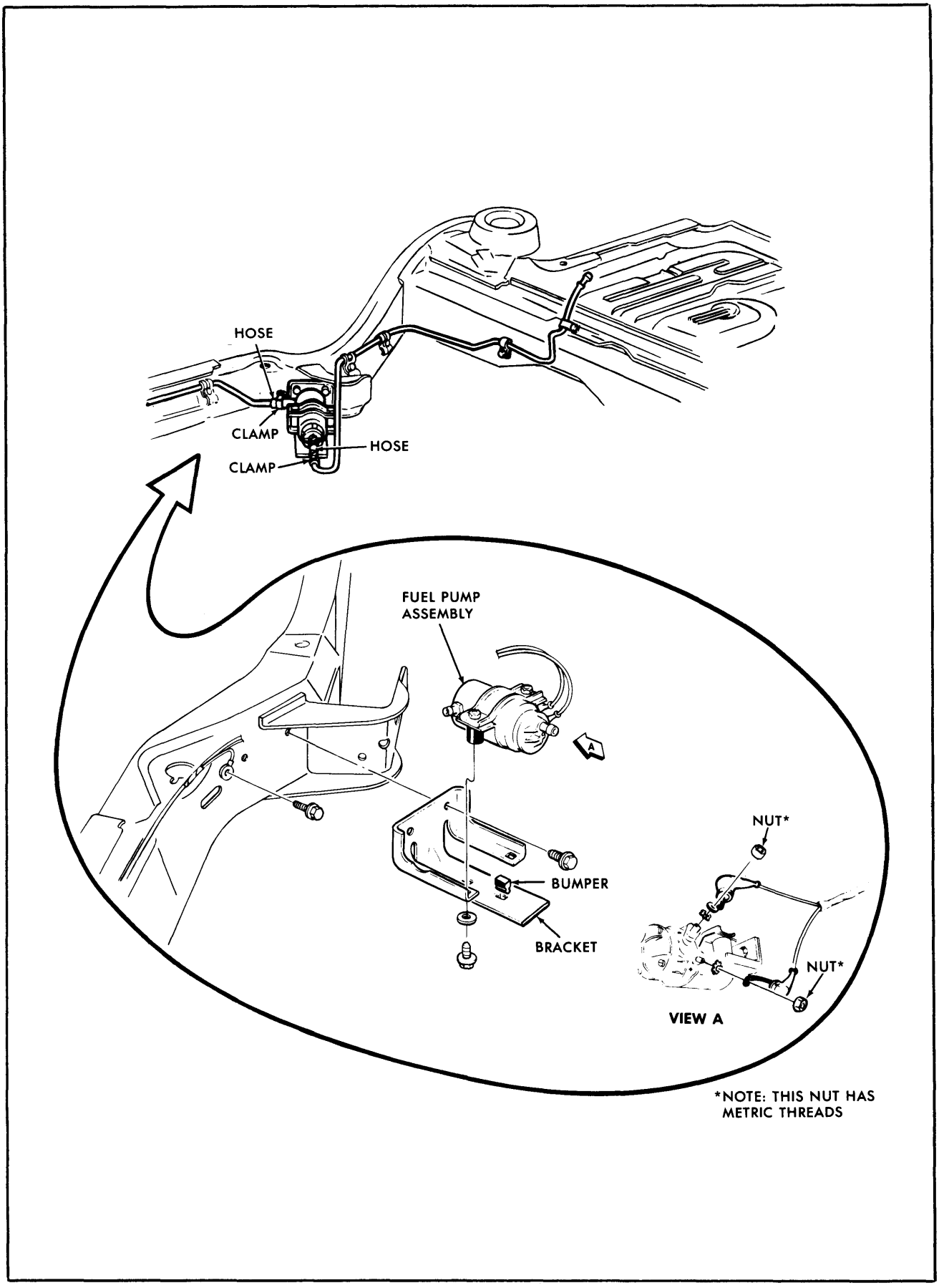


Fig. 6-146 Eldorado Fuel Pump

BACK TO INDEX

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79. Fuel Filter Assembly

a. Removal

WARNING: DO NOT LOOSEN FITTINGS UNTIL THE PRECAUTIONS DESCRIBED IN NOTE "22" HAVE BEEN TAKEN TO RELIEVE PRESSURE. FUEL IN SYSTEM MAY BE UNDER HIGH PRESSURE WHICH WOULD SPRAY OUT AND RESULT IN A FIRE HAZARD AND POSSIBLE PERSONAL INJURY.

1. Remove fuel inlet hose (flexible line), and discard clamp.
2. Remove fuel outlet line from fitting of fuel filter.
3. Remove two screws securing fuel filter assembly to bracket and remove fuel filter assembly.
4. Remove inlet and outlet fittings from filter assembly if needed for new assembly.
5. If it is necessary to remove fuel filter bracket, loosen lower mounting screw and remove upper mounting screw. Remove bracket and clean gasket surfaces.

b. Installation

1. If bracket was removed, position gasket to block using gasket cement to hold it in place and start bottom screw (Fig. 6-258).
2. Position bracket to block and install upper mounting screw and torque both screws to 12 foot-pounds (Fig. 6-158).
3. Install inlet and outlet fittings in fuel filter assembly (refer to Fig. 6-158 for correct position of fittings). Use sealer #1050805 or equivalent on fitting threads. Do not use teflon tape on fittings.
4. Position fuel filter to bracket and secure with two screws. Torque screws to 12 foot-pounds.
5. Connect fuel inlet line (flexible hose) and outlet line (tubing) to fuel filter fittings. Use new clamp.
6. A "dry" fuel system on cars equipped with EFI may require a substantial cranking period before starting.

80. Chassis-Mounted Fuel Pump

(NOTE: The chassis-mounted pump is located forward of the left rear wheel along the frame side rail except on Eldorado, which is located in a similar position on the right side of the car. Refer to Figs. 6-145 and 6-146.)

a. Removal

1. Remove fuel inlet and outlet hoses from nipples on pump.

WARNING: DO NOT LOOSEN FITTINGS UNTIL THE PRECAUTIONS DESCRIBED IN NOTE "22" HAVE BEEN TAKEN TO RELIEVE PRESSURE. FUEL IN SYSTEM MAY BE UNDER HIGH PRESSURE WHICH COULD SPRAY OUT AND RESULT IN A FIRE HAZARD AND POSSIBLE PERSONAL INJURY.

2. Peel back rubber boot and remove two nuts, one from each electrical terminal. Remove electrical leads.

(NOTE: These nuts have metric threads.)

3. Remove two screws with flat washers holding fuel pump to bracket and remove pump assembly.

b. Installation

1. Position fuel pump to mounting bracket as shown in Figs. 6-145 or 6-146 and secure with two screws with flat washers. Torque screw (Fig. 6-158). inch-pounds.
2. Position electrical leads to fuel pump terminals as follows: 14 dark green wire to positive terminal and 14 black wire to negative terminal. Secure with two nuts and reposition rubber boot.

(NOTE: These nuts have metric threads. Use new nuts supplied with each new pump or use nuts removed in step 2a.)

3. Install inlet and outlet hoses to fuel pump.
4. Check to insure that fuel pump is resting evenly on its two mounts and that it is not grounding against the bracket or frame.
5. A "dry" fuel system on cars equipped with EFI may require a substantial cranking period before starting.

81. In-Tank Fuel Pump

a. Removal

1. Remove fuel tank as described in note 14a.

WARNING: DO NOT LOOSEN FITTINGS UNTIL THE PRECAUTIONS DESCRIBED IN NOTE "22" HAVE BEEN TAKEN TO RELIEVE PRESSURE. FUEL IN SYSTEM MAY BE UNDER HIGH PRESSURE WHICH COULD SPRAY OUT AND RESULT IN A FIRE HAZARD AND POSSIBLE PERSONAL INJURY.

2. Remove locknuts securing fuel gage tank unit and fuel pump feed wires to tank unit.

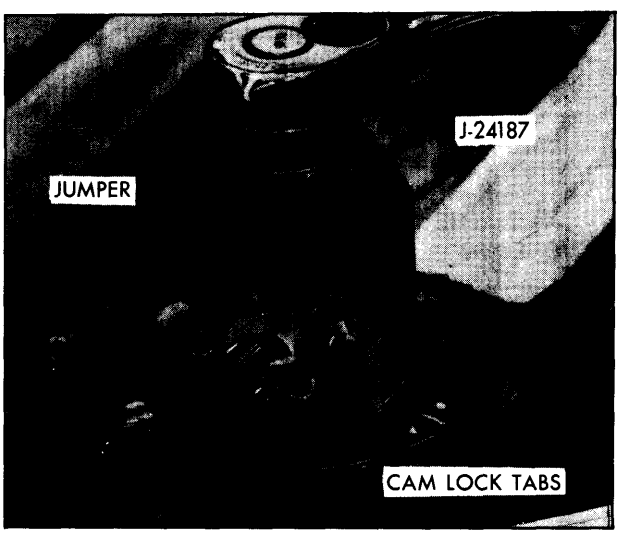


Fig. 6-147 Removing Lock Ring

BACK TO INDEX

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3. Position fuel tank sending unit remover and installer J-24187 on cam locking ring so that tool engages three tabs on ring, Fig. 6-147.

4. Install ratchet and turn counter clockwise to disengage lock ring from fuel tank. Remove tool and lift gage-pump unit from tank.

b. Installation

1. Install gage-pump unit in fuel tank, using new gasket.

2. Install fuel tank sending unit remover and installer J-24187 so that it engages three tabs on cam locking ring.

3. Turn clockwise until locking ring is fully engaged in fuel tank.

4. Connect electrical leads to fuel gage and secure with locknut.

5. Install fuel tank as described in note 14b.

6. A "dry" fuel system on cars equipped with EFI may require a substantial cranking period before starting.

82. Fuel Tank

a. Removal

1. Disconnect battery, open fuel tank filler door and disconnect sending unit feed wire (tan).

2. Construct a siphon hose as described in Section 8, note 5.

3. Insert the copper line end of the hose into the tank with natural curl of hose pointed down until the end rests on the bottom of the tank.

(NOTE: Difficulty may be experienced inserting the hose through the holes in the tank baffle. By turning the hose from side to side, continue inserting the hose through the baffle to the bottom of the tank.)

(NOTE:, Tank can be siphoned more rapidly by raising the car one foot higher in the rear than the front.)

4. Insert an air hose into the slit. A short blast of air will cause the fuel to flow.

5. Raise car.

6. Remove screw securing ground wire to cross member.

7. Disconnect fuel line, evaporative loss control system and return lines at front of tank.

WARNING: DO NOT LOOSEN FITTINGS UNTIL THE PRECAUTIONS DESCRIBED IN NOTE "22" HAVE BEEN TAKEN TO RELIEVE PRESSURE. FUEL IN SYSTEM MAY BE UNDER HIGH PRESSURE WHICH COULD SPRAY OUT AND RESULT IN A FIRE HAZARD AND POSSIBLE PERSONAL INJURY.

8. Support tank with jack and wood block and remove one screw, each side, securing fuel tank support straps to body at front of tank.

9. Lower jack and fuel tank to a position where fuel pump lead may be removed.

10. Remove fuel tank.

b. Installation

1. Position tank near underbody and attach fuel pump lead wire (14 green) to terminal marked "pump".

2. Move tank to underbody; position fuel tank support straps under tank and loosely install screws securing straps to body.

3. Secure ground wire to rear cross member.

4. Tighten tank strap screws until bottomed. Torque to 25 foot-pounds.

5. Connect fuel line, evaporative loss control system line and return line to fittings at front of tank. Secure with new clamps.

6. Lower car.

7. With fuel filler door open, connect sending unit feed wire (tan).

8. Replace drained fuel in tank.

9. A "dry" fuel system on cars equipped with EFI may require a substantial cranking period before starting.

83. Air Temperature Sensor

a. Removal

1. Locate air temperature sensor at right rear of intake manifold and disconnect sensor from car harness.

2. Remove sensor from intake manifold.

b. Installation

1. Apply a non-hardening sealer (such as GM 1050805 or equivalent) to threads of sensor and install sensor in intake manifold.

2. Tighten sensor to 15 foot-pounds.

3. Connect air temperature sensor connector to car harness.

84. Coolant Temperature Sensor

a. Removal

1. Drain radiator until coolant level is below level of cylinder heads.

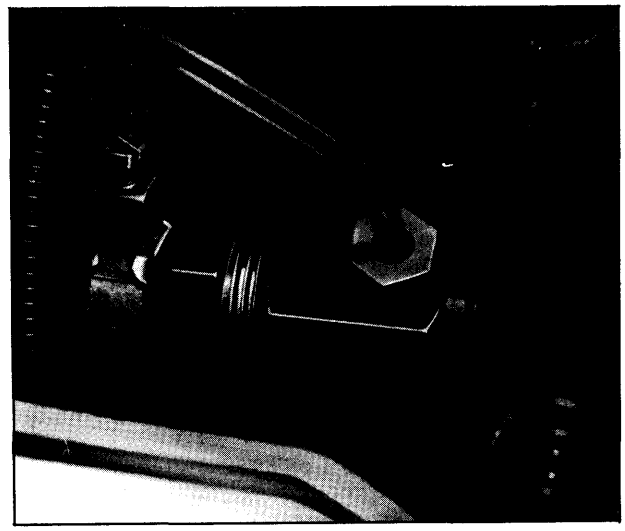


Fig. 6-148 Temperature Sensor

BACK TO INDEX

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2. Locate water temperature sensor in heater hose outlet at rear of right hand cylinder head, Fig. 6-148, and disconnect sensor from car harness.
3. Remove sensor from position in heater hose.

b. Installation

1. Apply a non-hardening sealer (such as GM 1050805 or equivalent) to threads of sensor and install sensor in heater hose outlet fitting.
2. Tighten sensor to 15 foot-pounds.
3. Connect coolant temperature sensor connector to car harness.
4. Fill cooling system to proper level.

85. Distributor Service

a. Removal

Distributor removal remains the same as for carbureted vehicles except the speed sensor (distributor trigger) electrical connector must be disconnected prior to removal.

b. Disassembly

(NOTE: Several distributor components may be installed in more than one way which could adversely effect engine performance. Close adherence to the following procedures is essential for proper operation.)

1. Remove distributor as described in note 32 and part "a" above.
2. Remove rotor from distributor shaft by removing two screws.
3. Remove advance springs and remove advance weights.
4. Remove two truarc clips securing distributor cam to shaft and remove distributor cam.
5. Remove four screws securing speed sensor to distributor housing and remove sensor and gasket.
6. Remove plug from opposite side of sensor housing on distributor.
7. Remove roll pin from drive gear.

CAUTION: Distributor drive gear should be supported in such a way that no damage will occur to distributor shaft while removing pin.

8. Remove gear shim and tanged washer from distributor shaft. Remove any burrs that may have been caused by removal of pin.
9. Support distributor shaft and remove roll pin from speed sensor rotating magnet.
10. Remove distributor shaft from housing and remove speed sensor rotating magnet from housing.
11. Remove timer core from distributor shaft.
12. Remove electrical leads from module and remove two module mounting screws. Remove module.
13. Remove three screws securing pole piece to housing and remove pole piece, magnet and pick-up coil from housing.
14. Remove lock ring at top of housing and remove pick-up coil retainer, shim and felt washer.

(NOTE: No attempt should be made to service the shaft bushings in the housing.)

15. Remove vacuum advance mechanism by removing two screws.
16. Disconnect capacitor lead and remove capacitor by removing one screw.
17. Remove wiring harness from distributor housing.

c. Assembly

(NOTE: Several distributor components may be installed in more than one way which could adversely effect engine performance. Close adherence to the following procedures is essential for proper operation.)

1. Position vacuum advance unit to housing and secure with two screws.
2. Position felt washer over lubricant reservoir at top of housing.
3. Position shim on top of felt washer.
4. Position pick-up coil retainer to housing with vacuum advance arm over actuating pin of vacuum advance mechanism. Secure with lock ring.
5. Install pick-up coil magnet and pole piece. Loosely install three screws holding pole piece.
6. Install washer to top of housing.
7. Install timer core on distributor shaft.
8. Install distributor shaft and rotate to check for even clearance all around between pole piece and timer core.
9. Move pole piece to provide even clearance and secure with three screws.
10. Remove distributor shaft to a position where speed sensor rotating magnet may be installed in position in distributor housing.
11. Engage speed sensor rotating magnet on distributor shaft and install shaft in position. Do not install roll pin.
12. Install tanged washer (teeth up), shim and drive gear to bottom of shaft.
13. Note that the distributor drive gear has a dimple on one side next to the drive pin hole. Align the drive gear so that the dimple is on the same side of the shaft as the rotor pointer. Temporarily install the rotor to insure that alignment is correct.
14. Install drive gear using new roll pin.
15. Align speed sensor rotating magnet as shown in Fig. 6-149 and install new roll pin.
16. Install plug in distributor housing behind speed sensor.
17. Using a new gasket, position speed sensor to distributor housing with wiring harness coming out of top of sensor (directly below distributor housing) and secure with four screws.
18. Position capacitor to housing and loosely install one mounting screw.
19. Install connector to "B" and "C" terminals on module with tab on top.
20. Apply special silicone lubricant liberally to bottom of module and secure with two screws.
21. Position wiring harness with grommet in housing notch.
22. Connect pink wire to capacitor stud, and black wire to capacitor mounting screw. Tighten screw.
23. Connect white wire from pick-up coil to terminal "W" of module.

BACK TO INDEX
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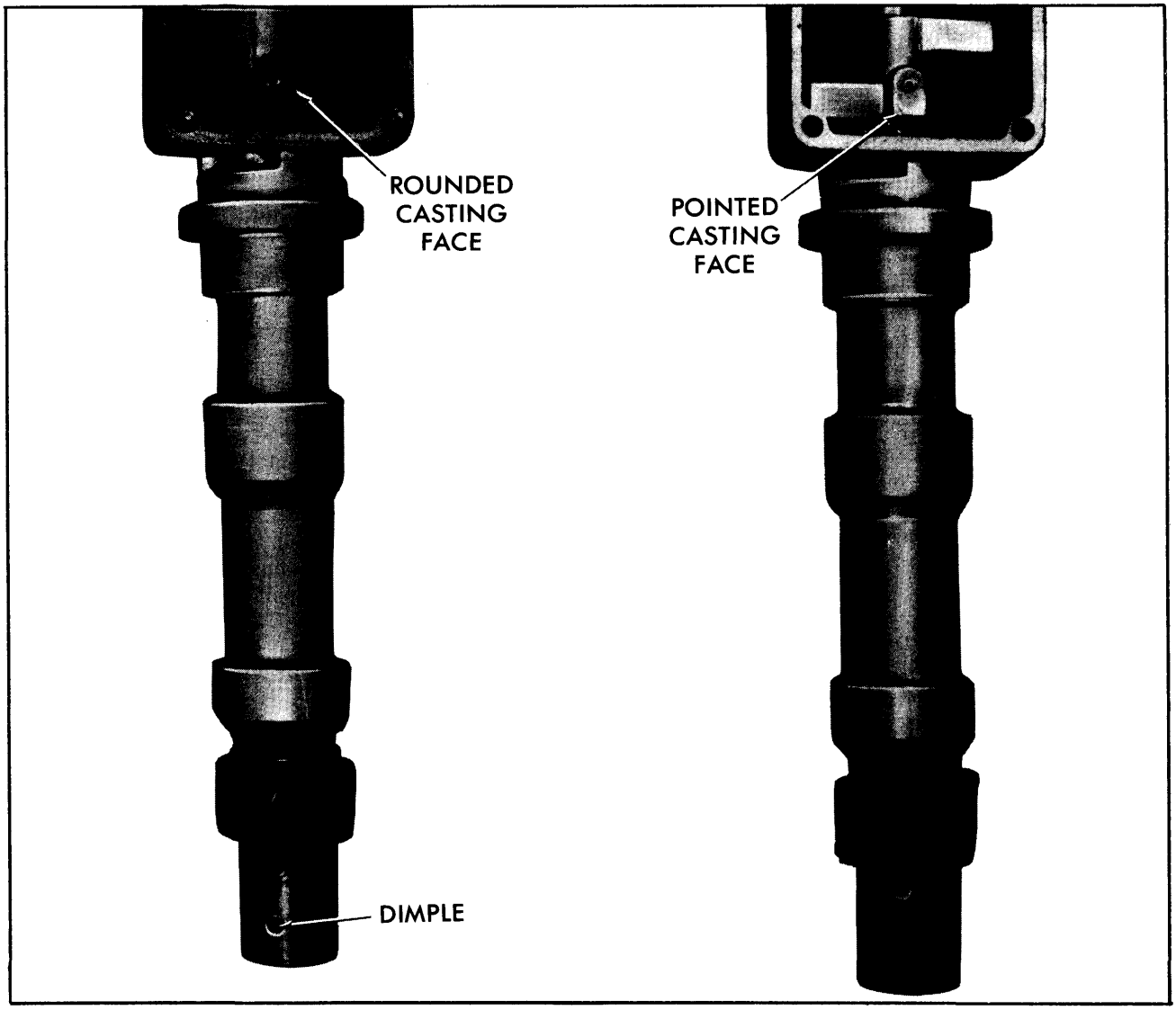


Fig. 6-149 Speed Sensor Location

24. Connect white with green stripe wire from pick-up coil to terminal "G" of module.

25. Install distributor advance cam over pins on distributor shaft with stamped numbers facing up and secure cam with two truarc rings.

26. Install centrifugal advance weights with letters or numbers up. Install springs with large loop in-board and offset up.

27. Check advance weights for smooth operation.

28. Install rotor and secure with two screws.

CAUTION: Notch on side of rotor must engage tab on cam weight base.

d. Installation

Distributor installation is the same as for carbureted engines note 32, except that the speed sensor wires must be connected to the engine harness.

86. Distributor Testing

For service departments equipped with distributor testing equipment, the following information on performance characteristics is provided.

BACK TO INDEX

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ALL FEDERAL CARS WITH FUEL INJECTION

CENTRIFUGAL ADVANCE		VACUUM ADVANCE	
Distributor RPM	Distributor Advance	Inches of Mercury	Distributor Advance
200	0°	5	0° to 1°
450	-1° to 1¾°	6	1° to 3°
600	1° to 3°	8	4° to 6°
800	1½° to 3°	10	7° to 9°
1000	2° to 4°	12	9° to 11½°
1400	3° to 5°	14	11½° to 13½°
1700	4° to 6°	15	12½° to 14½°
2100	5° to 7°	16	13½° to 14½°
2500	6° to 8°		

ALL CALIFORNIA CARS WITH FUEL INJECTION

CENTRIFUGAL ADVANCE		VACUUM ADVANCE	
Distributor RPM	Distributor Advance	Inches of Mercury	Distributor Advance
300	0°	5½"	0°
500	0° to 4°	7"	0° to 2°
650	2° to 6°	13"	8½° to 10½°
1400	5° to 10°	14"	9½° to 10½°

ADJUSTMENTS

87. Idle Speed

1. Disconnect parking brake hose at vacuum release cylinder and plug hose. Set parking brake and block wheels. Disconnect air leveling compressor hose at air cleaner and plug hose.
2. Connect tachometer, start and warm-up engine to operating temperature in park.
3. Place transmission selector lever in drive, turn air conditioning off.
4. Loosen lock nut on idle by-pass adjusting screw on front of throttle body, Fig. 6-150.
5. Adjust idle by-pass adjusting screw to give 600 rpm.
6. Tighten lock nut on idle by-pass adjusting screw.
7. Shut off engine. Remove tachometer.
8. Reconnect all disconnected hoses.

88. Throttle Position Switch Adjustment

1. Loosen two throttle position switch mounting screws to permit rotation of the switch.
2. Hold the throttle valves in the idle position while performing step 3 and 4.
3. Turn the throttle position switch carefully counterclockwise until the end-stop has been reached.
4. Tighten throttle position switch mounting screws to 11 in-lbs.
5. Check to insure that throttle valves close to the throttle stop. If not, repeat steps 2, 3 and 4.

89. Ignition Timing and Idle Speed Adjustment

a. Strobe Light Timing

1. With engine at normal operating temperature, loosen distributor clamp nut to allow distributor to be turned by hand but without excessive looseness.
2. Disconnect vacuum advance unit hose and plug hose.
3. Disconnect parking brake vacuum hose at diaphragm and plug hose.
4. Disconnect ALC vacuum hose at air cleaner and plug hose.
5. Connect a suitable timing light to No. 1 or No. 4 ignition lead.

(NOTE: If spark plug adapters are not available, disconnect No. 1 spark plug wire and connect timing light to wire. Time engine on seven cylinders. Do not force pins or wires thru spark plug nipple.)

6. Connect tachometer to engine (use HEI terminal marked "Tach").
7. Set parking brake, start engine and place transmission selector lever in "Drive".
8. Turn Air Conditioning to "OFF" position.
9. With idle speed at 600 RPM or less, observe timing light flashes on pulley in relation to notches on front cover. Set timing to 12 degrees before top dead center.
10. Tighten clamp nut to 18 foot-pounds and recheck timing to make sure that it did not change.
11. Connect vacuum hose to vacuum advance unit and adjust idle speed to 600 RPM with transmission in "Drive", by adjusting idle speed screw in front of throttle body, Fig. 6-150.

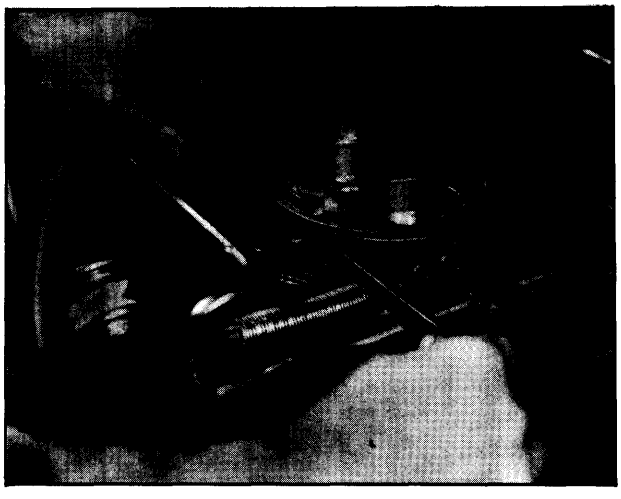


Fig. 6-150 Adjusting Idle Speed

BACK TO INDEX

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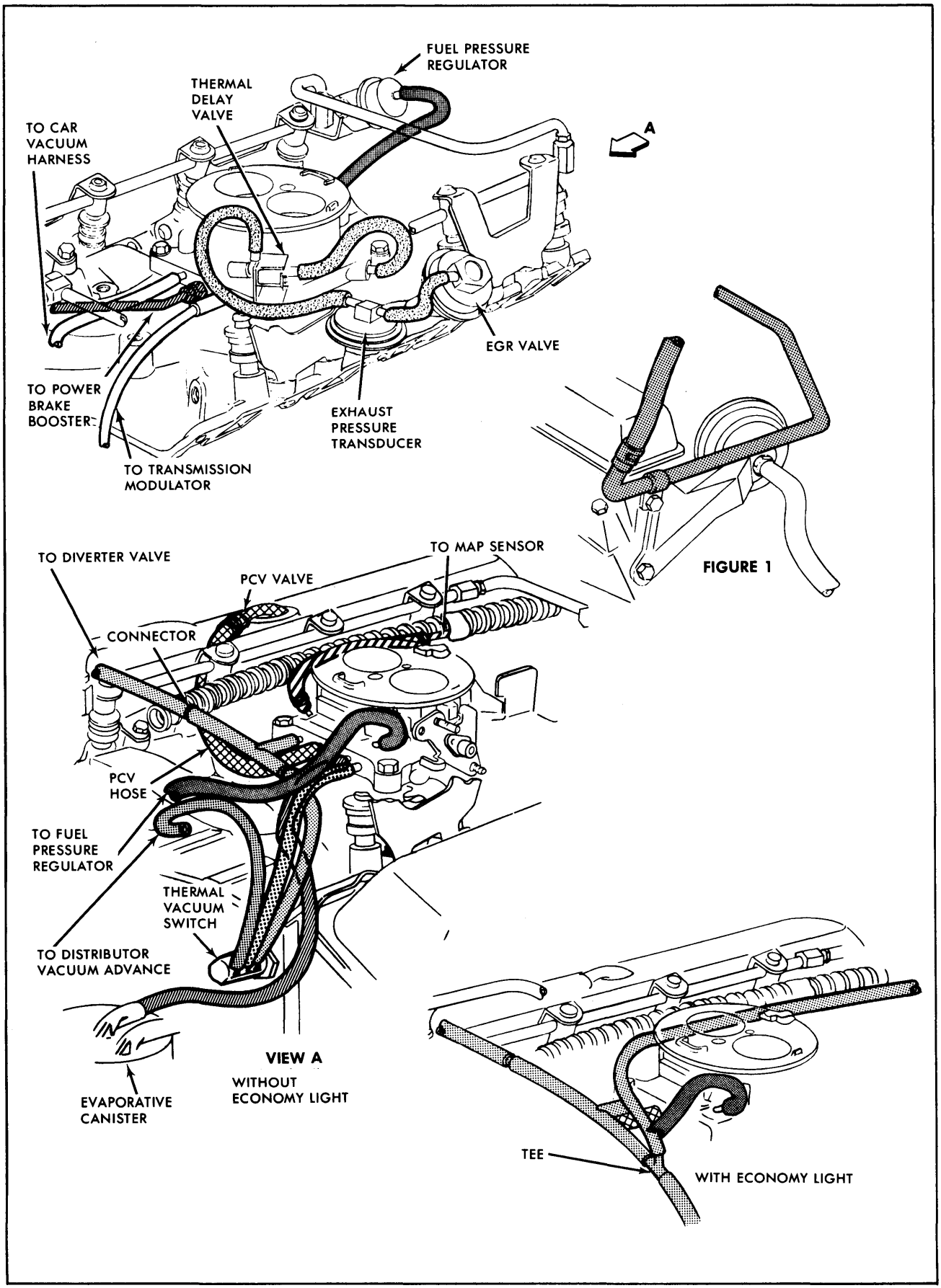


Fig. 6-151 Vacuum Hose Routing

BACK TO INDEX

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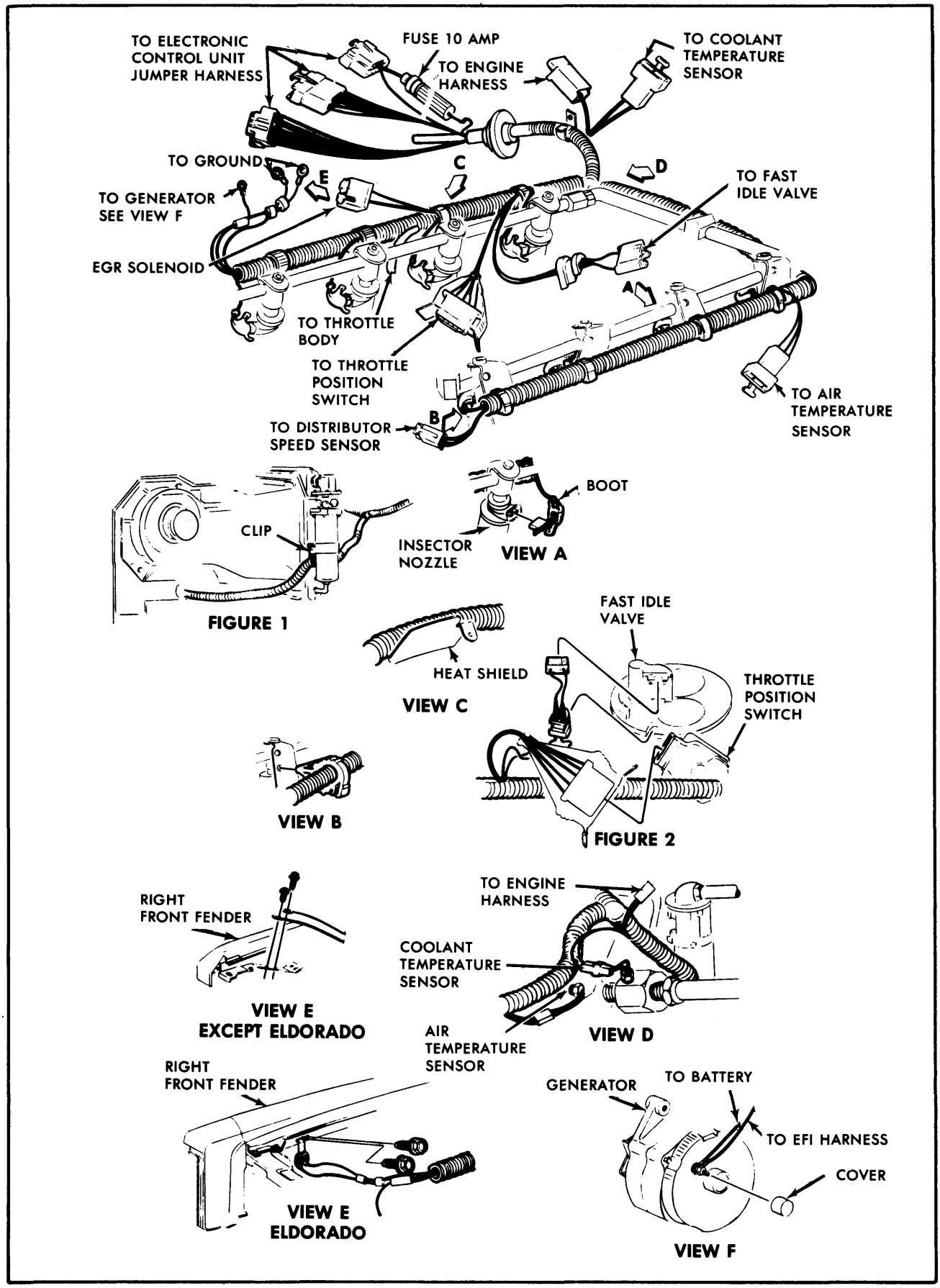


Fig. 6-152 Electrical Connections

BACK TO INDEX

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12. Stop engine and disconnect timing light and tachometer. Reconnect all vacuum hoses.

b. Timing Advance Meter

1. With engine at normal operating temperature, loosen distributor clamp nut to allow distributor to be turned by hand but without excessive looseness.
2. Disconnect vacuum advance unit hose and plug hose.
3. Disconnect parking brake vacuum hose at diaphragm and plug hose.
4. Disconnect ALC vacuum hose at air cleaner and plug hose.
5. Connect power supply for timing meter to battery. Observe correct polarity.
6. Install ignition pick-up clip over No. 1 spark plug wire. Be sure jaws are clean and locking button is pressed forward to close jaws firmly.
7. Install magnetic pick-up in receptacle of timing tab and press down firmly to contact the pulley surface.
8. Make sure that all leads to advance meter are out of way of moving parts and exhaust manifold.
9. Turn power switch ON and timing-advance switch to TIMING position.
10. Start engine. Turn A/C OFF.
11. With idle speed at 600 RPM or less, observe ENGINE DEGREES meter and set timing to 12 degrees before top dead center (+12 on meter).
12. Tighten clamp nut to 18 foot-pounds and recheck timing to make sure that it did not change.
13. Connect vacuum hose to vacuum advance unit and adjust idle speed to 600 RPM with transmission in "Drive" by adjusting idle speed screw in front of throttle body, Fig. 6-150.
14. Stop engine and disconnect timing meter. Reconnect all vacuum hoses.

GENERAL INFORMATION

90. Relieving Fuel Pressure

Fuel in the fuel system may be under pressure and could spray out while loosening fittings. Refer to the appropriate section below to relieve this pressure.

a. Without Pressure Fitting

On early production cars without a pressure fitting in the rear fuel rail, cover the fitting to be removed with a shop towel while loosening so that fuel will be absorbed. Dispose of gasoline properly.

b. With Pressure Fitting

Later production cars are equipped with a "Schrader" fitting in the rear fuel rail. To relieve fuel pressure proceed as follows:

1. Remove protective cap from pressure fitting.
2. Loosely install valve depressor J-5420 on fitting.
3. Arrange a shop towel or suitable container so that displaced fuel will be contained.
4. Slowly tighten valve depressor J-5420 until pressure is relieved.
5. Dispose of gasoline properly.
6. Remove valve depressor and install protective cap.
7. Proceed with fuel system service.

91. Differences in Fuel Injection Equipped Vehicles

Cadillac cars equipped with the Fuel Injection System incorporate special components in some areas to accommodate the Fuel Injection System. The following features should be kept in mind when working on Fuel Injection equipped vehicles:

a. Accelerator Linkage

The accelerator linkage shown in Fig. 6-153, is specific to fuel injected vehicles.

b. Cruise Control

Fig. 6-154 shows the power servo mounting and linkage arrangement for vehicles equipped with both fuel injection and Cruise Control.

c. EGR System

The Exhaust Gas Recirculation (EGR) System for fuel injection equipped vehicles is shown in Fig. 6-155.

The EGR vacuum solenoid valve is controlled by the ECU and is installed in the signal line to the EGR valve. The ECU keeps the solenoid valve closed below approximately 130°F. (52°C.) coolant temperature, blocking the signal to the EGR valve. This allows improved cold starts and engine warm up. The ECU opens the solenoid valve above approximately 130°F. (52°C.) coolant temperature, allowing ported vacuum to be directed to the EGR exhaust-pressure transducer and EGR valve.

A thermal delay valve is not used.

d. PCV System

The Positive Crankcase Ventilation (PCV) System is shown in Fig. 6-156. While there are no specific parts, the arrangement is slightly different.

e. Air Conditioning System

The compressor rear mounting bracket, Fig. 6-157, is specific for fuel injected vehicles. The high and low pressure connections at the rear head of the compressor, Fig. 6-157, are individual connectors.

The high pressure fitting is a new thread size-smaller than previous fittings. Adapter J-25498 is required when servicing the air conditioning system. Different sizes are used to prevent accidentally connecting low side line to the high side fitting.

f. Engine Removal and Installation

Removal and installation procedures are included in this manual as the operations are basically the same.

BACK TO INDEX

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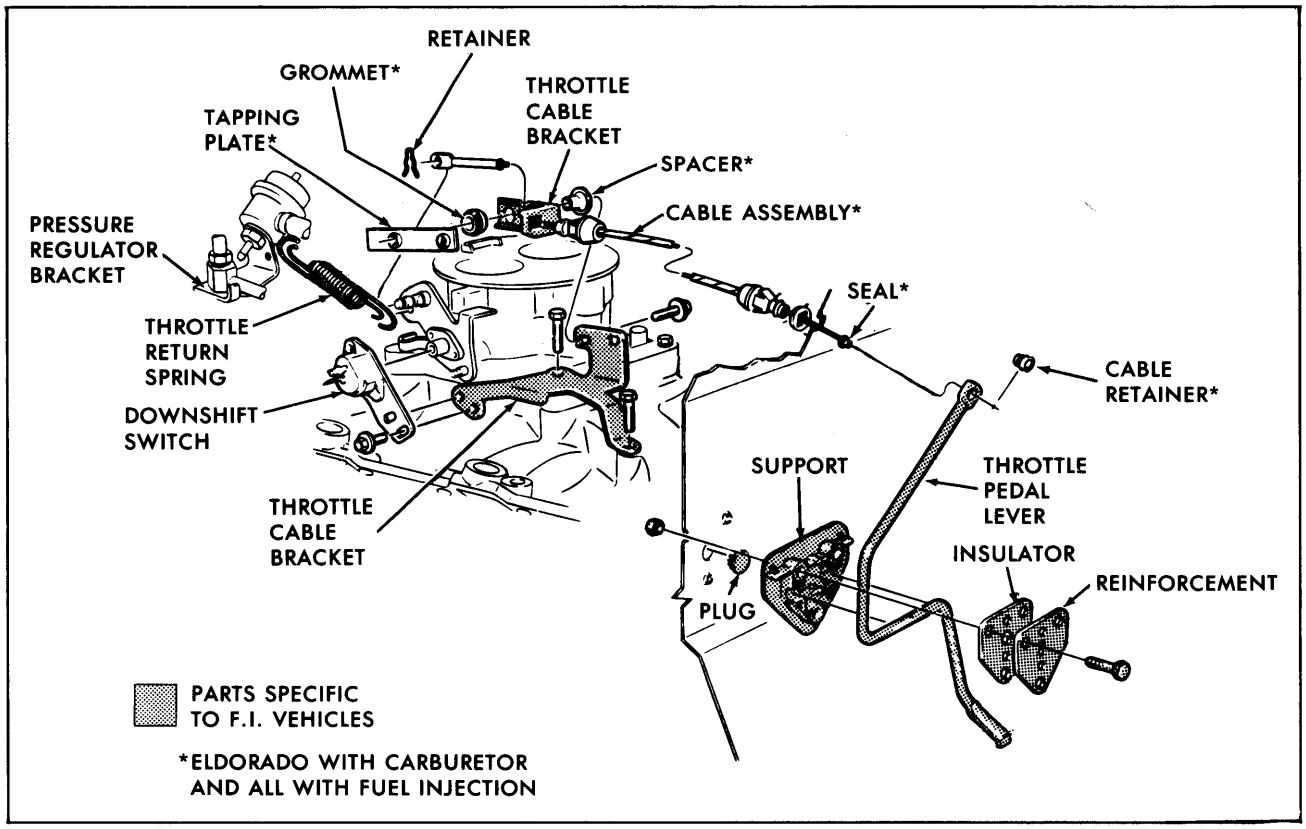


Fig. 6-153 Throttle Linkage

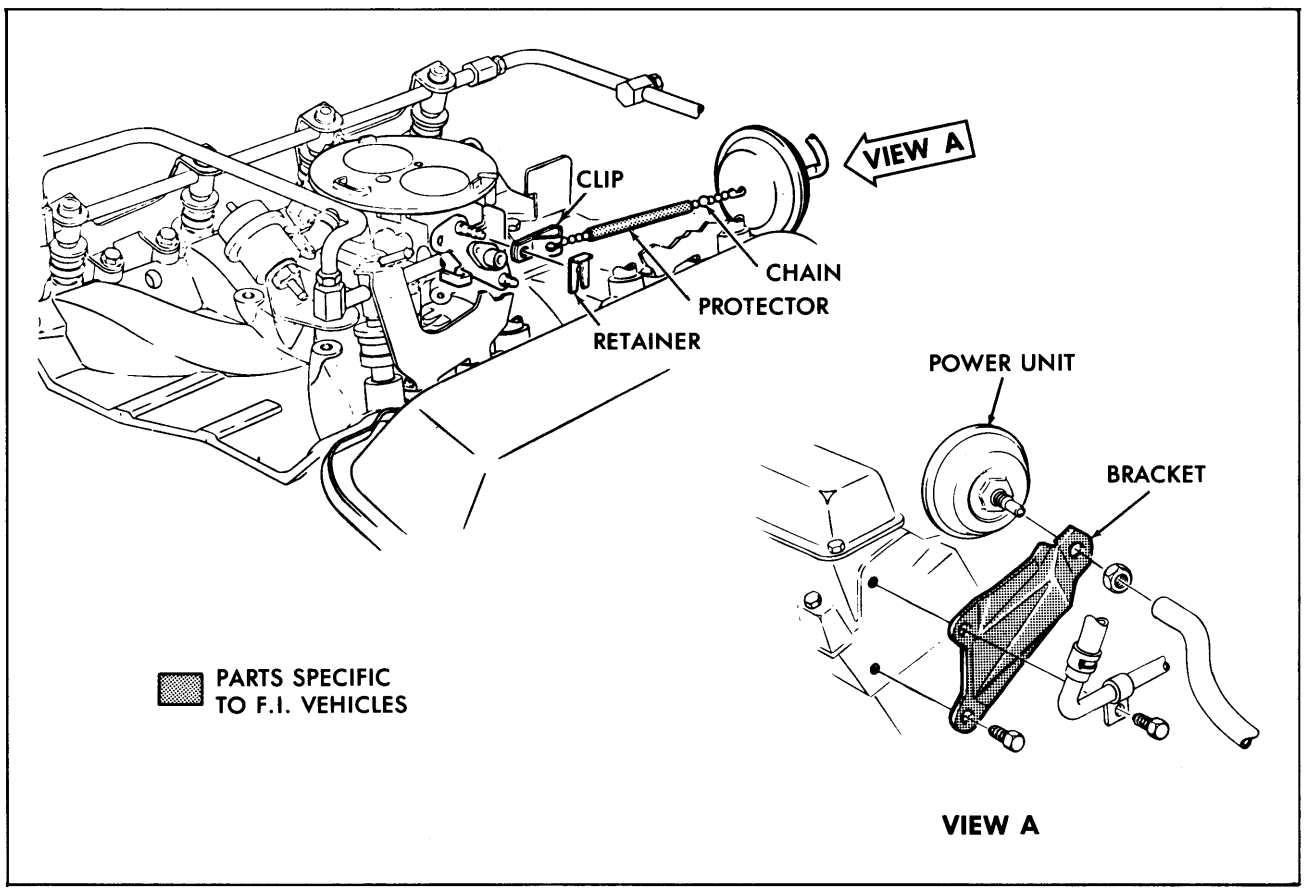


Fig. 6-154 Cruise Control Installation

BACK TO INDEX

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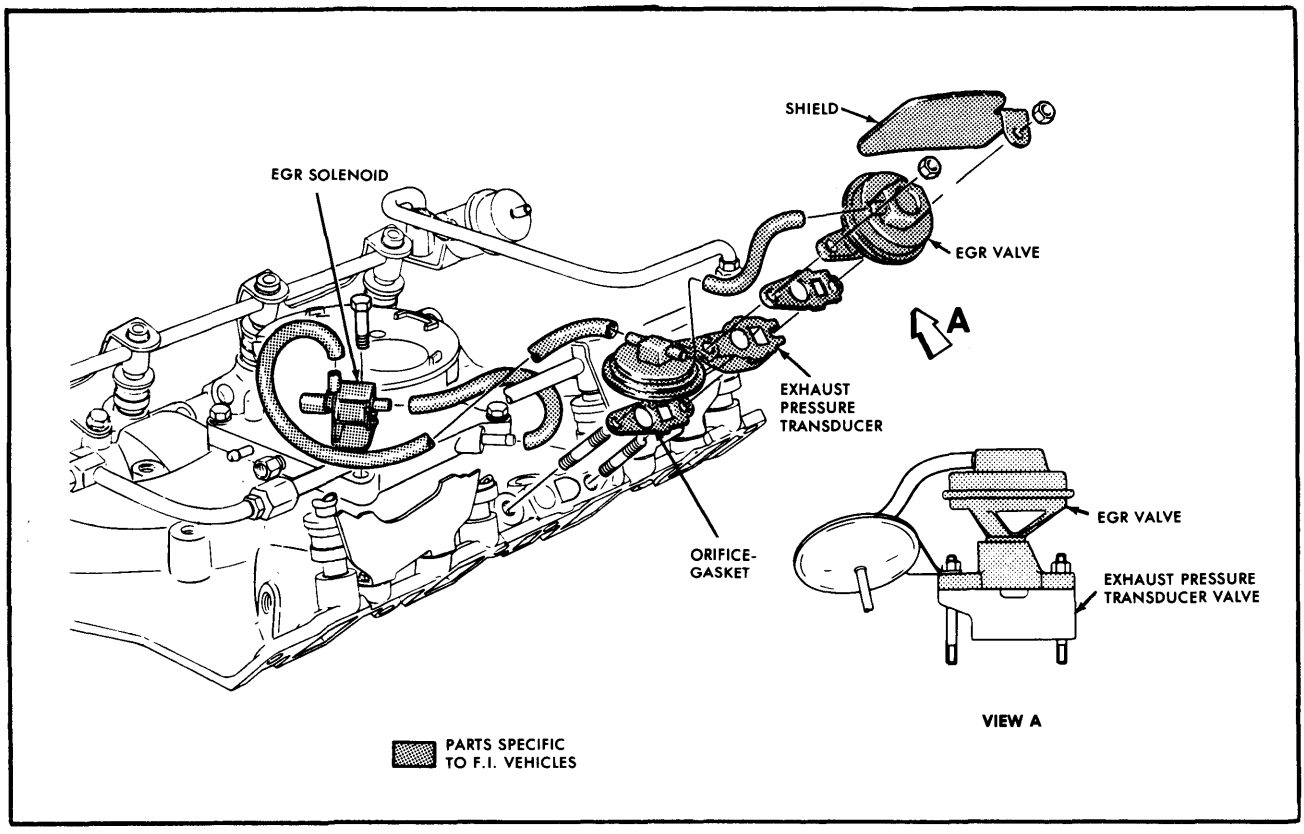


Fig. 6-155 EGR System

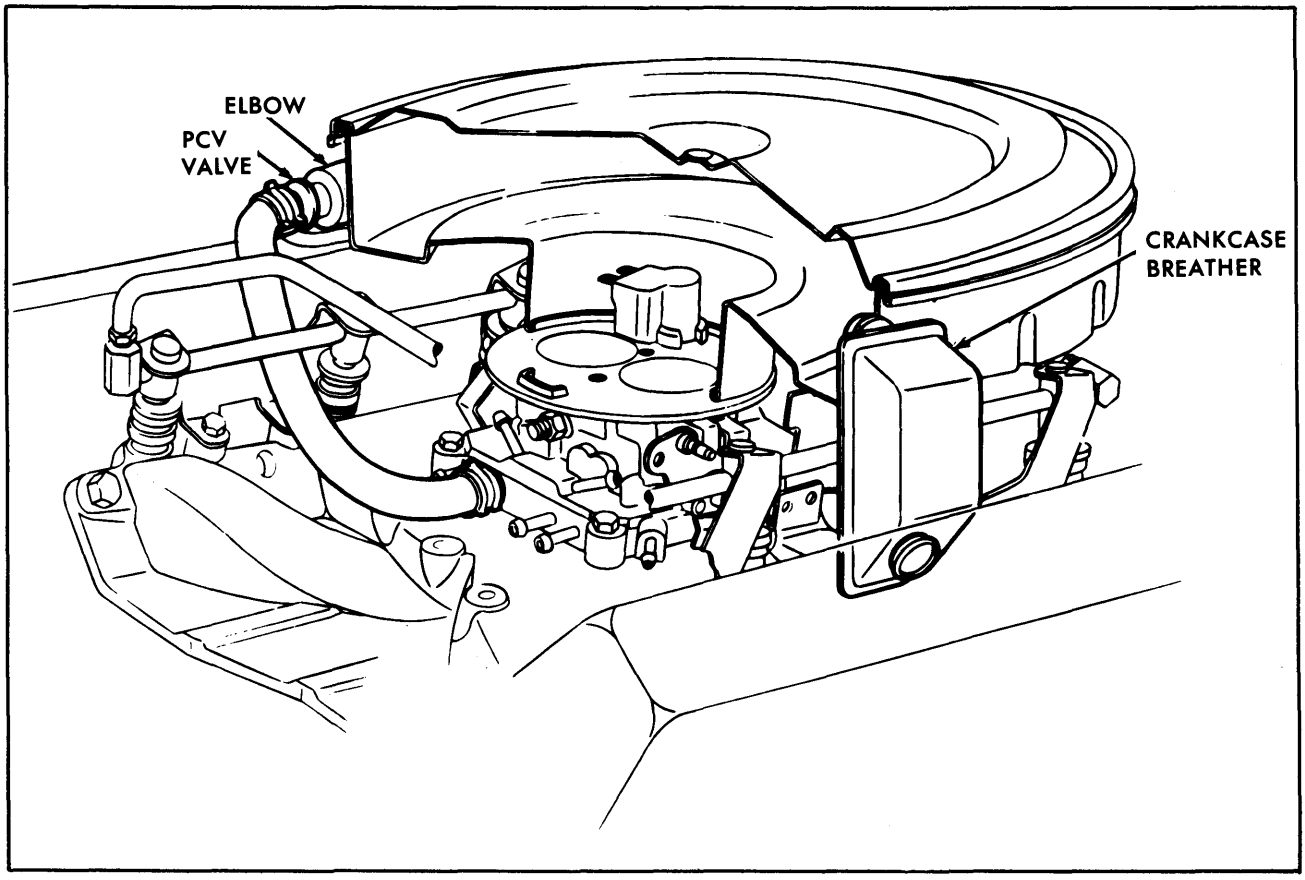


Fig. 6-156 PCV System

BACK TO INDEX

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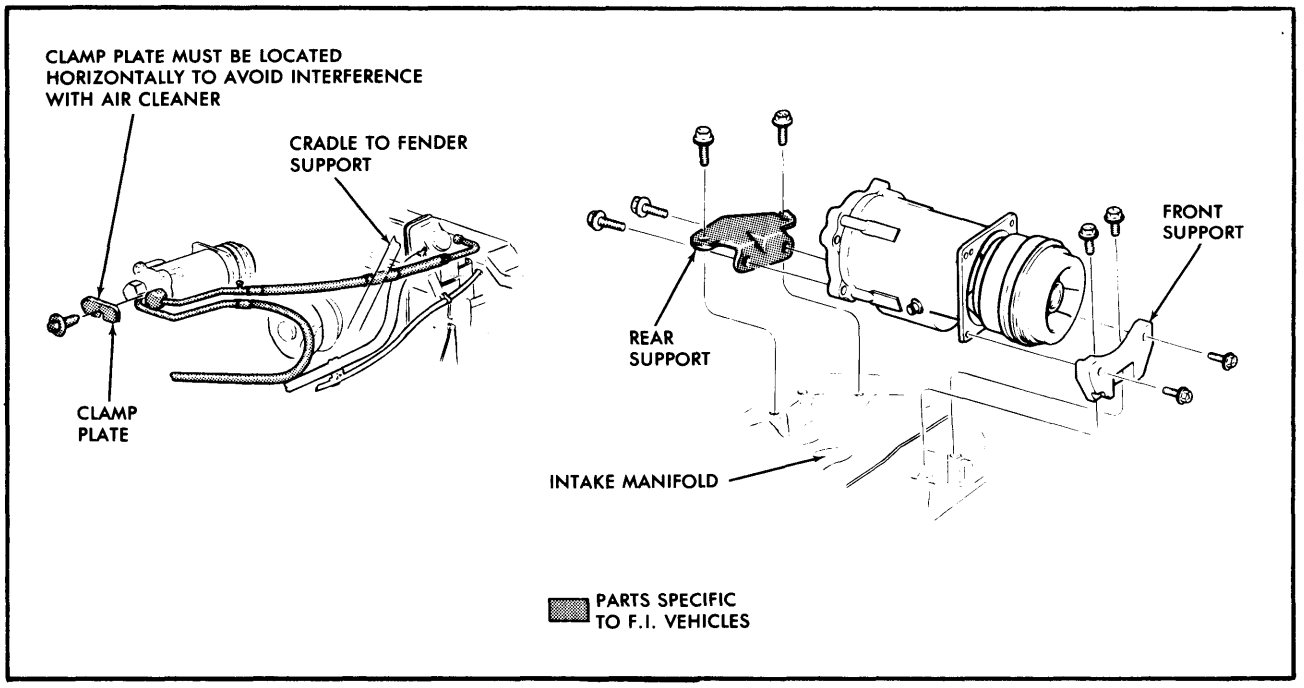


Fig. 6-157 Air Conditioning Compressor

However, engine lifting hooks are not supplied with each engine for this purpose as is the case on carbureted vehicles. Special Tool J-25511 is provided for this purpose. This special bracket should be installed under the center two intake manifold screws after the throttle body is removed.

The bracket should be removed after the engine is installed and retained for future use.

g. Generator

The 80 amp generator which is optional on other 1975 Cadillacs, is standard equipment on vehicles with electronic fuel injection.

h. Transmission

Due to the performance characteristics of the fuel injection engine, the transmission used in these vehicles has a modified valve body. This special transmission is designated AB for "C"-cars and AK for Eldorados.

i. EFE Valve

The Early Fuel Evaporation valve used on carbureted vehicles is not used with fuel injection. A spacer is used between the right hand exhaust manifold and exhaust pipe so that these components are not specific.

j. Cylinder Heads

The AIR ports to cylinders 4 and 5 are not drilled on fuel injection engines depriving air pump delivery to these two-exhaust ports as part of the emission control calibration.

k. Oil Pressure Switch

A single terminal Oil Pressure Switch is used on fuel injection engines.

l. Thermal Vacuum Switch

The thermal vacuum switch used to control the distributor spark advance on fuel injection engines has control point of 220°F. (105°C.) rather than 150°F. (66°C.) on the switch used with carbureted engines.

92. Difference Between "C" and "E" Cars

The configuration of the fuel injection system for "C" and "E" cars is identical with the following exceptions:

a. The "C" car chassis-mounted fuel pump is mounted on the frame forward of the left rear wheel (Fig. 6-145).

b. The "E" car chassis-mounted fuel pump is mounted on the frame forward of the right rear wheel (Fig. 6-146).

c. There is a difference in calibration between the ECU used in California vehicles and ECU used in other states, ("Federal" vehicles). The two units are not functionally interchangeable.

(NOTE: Each ECU assembly is labeled for its intended use. Be sure to use the proper unit for each application.)

d. There is a difference in calibration between the ECU used on "C" series vehicles and "E" series vehicles which makes them not interchangeable.

(NOTE: Each ECU assembly is labeled for its intended use. Be sure to use the proper unit for each application.)

e. The EGR valve and orifice-gasket under the transducer is specific for each application ("C" series, "E" series, Federal vehicles, California vehicles).

BACK TO INDEX

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93. Reference Drawings

The following illustrations are provided to show the proper arrangement of parts and assemblies that are specific to vehicles with Electronic Fuel Injection. Components not shown in this manual remain the same as for carbureted vehicles.

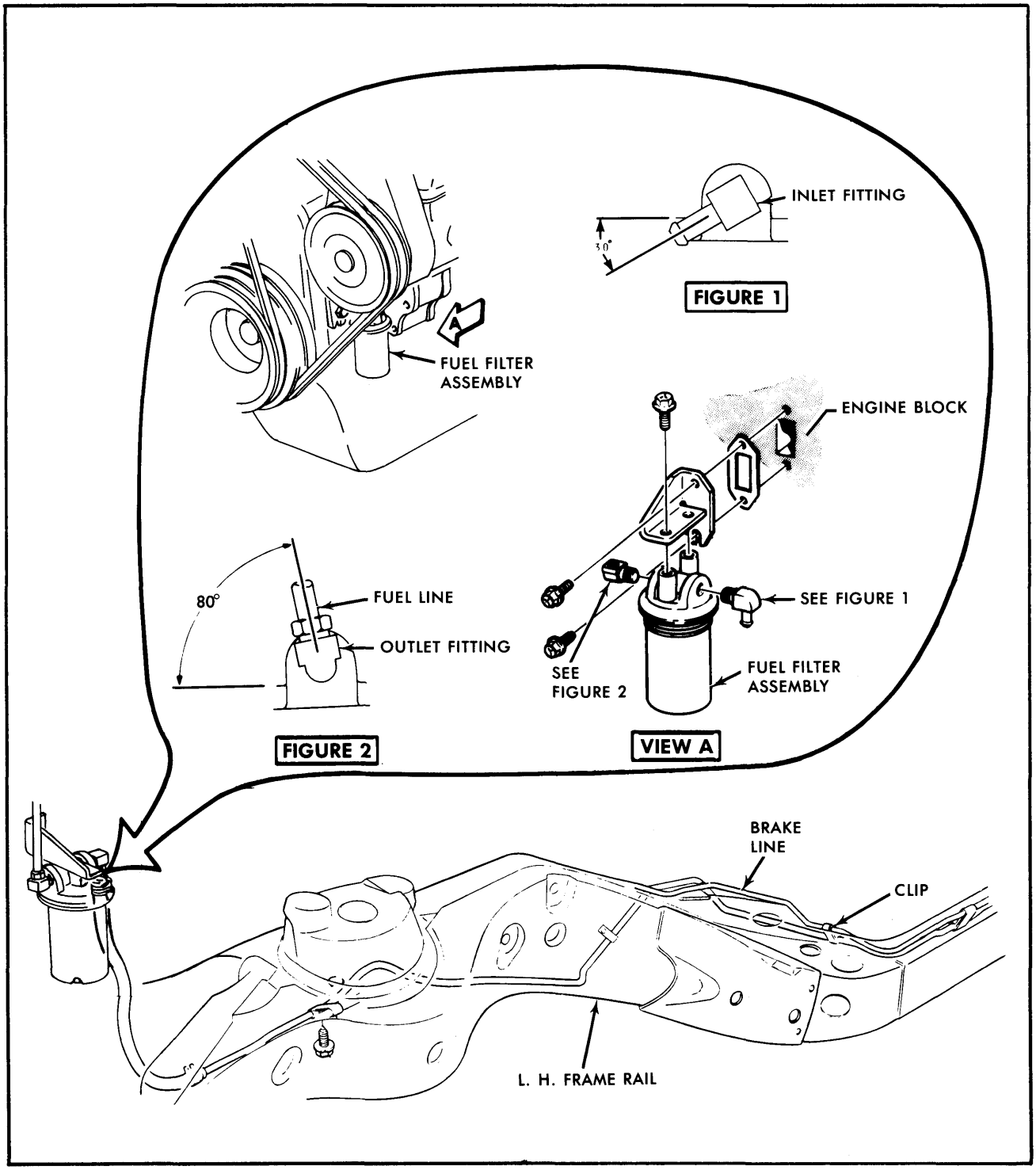


Fig. 6-158 Fuel Filter Installation

BACK TO INDEX

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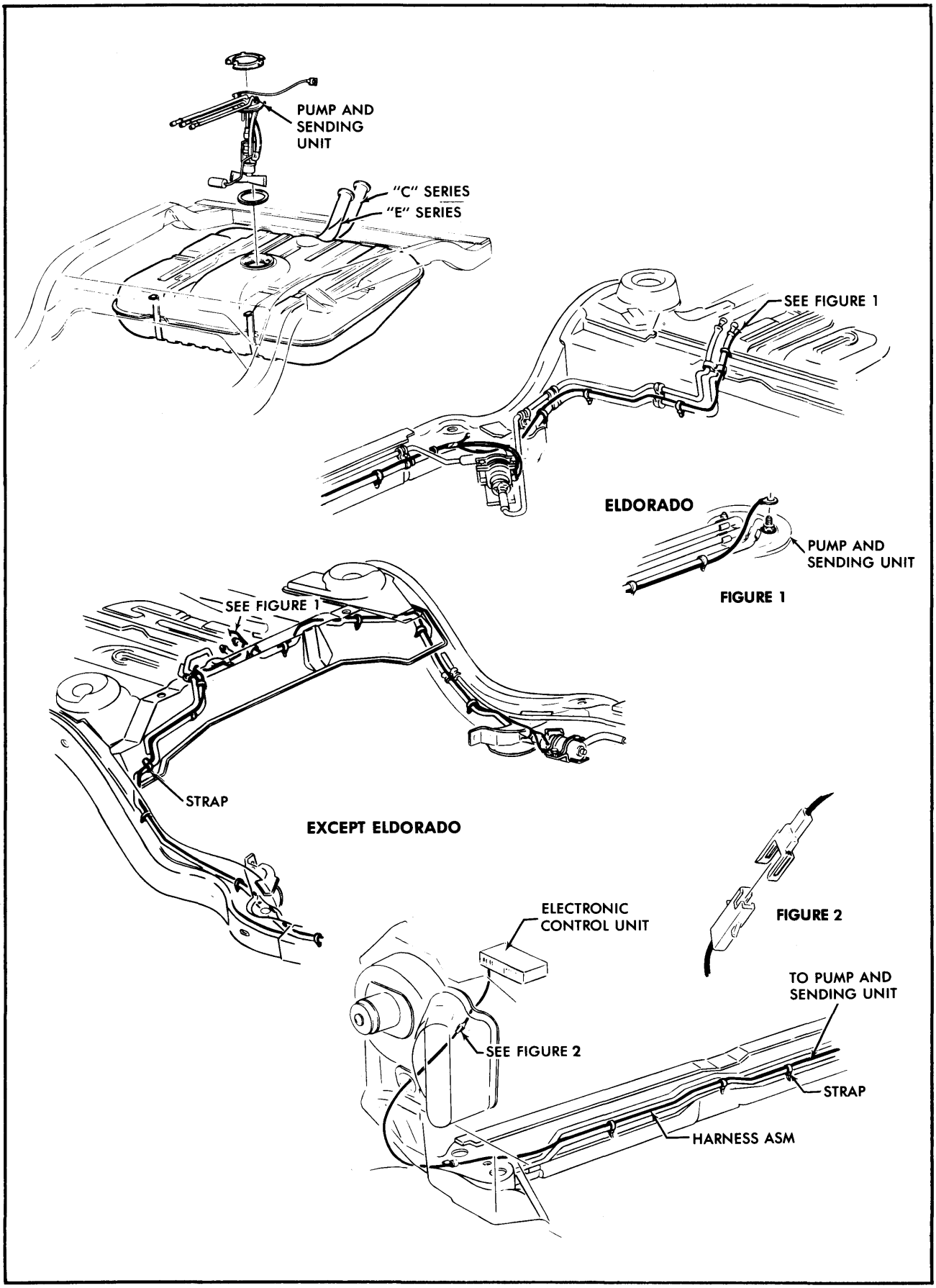


Fig. 6-159 Fuel Lines

BACK TO INDEX

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TORQUE SPECIFICATIONS

APPLICATION	FOOT-LBS
Air Conditioning Compressor Rear Bracket to Manifold and Compressor	40
Refrigerant Hose Clamp Plate	30
Throttle Linkage Bracket to Manifold	14
Downshift Switch Mounting Screws	22 In-Lbs.
Throttle Linkage Support to Firewall	60 In-Lbs.
EGR Valve Stud (Rear)	130 In-Lbs.
EGR Valve Mounting Nuts	17
EGR Valve Stud (Front)	130 In-Lbs.
Fuel Pump Mounting Screw	25 In-Lbs.
Fuel Pump Bracket to Frame	130 In-Lbs.
Throttle Body Mounting Screws	15
Thermal Vacuum Switch	22
ECU Support Rod to Cowl	60 In-Lbs.
ECU Support Rod to ECU	75 In-Lbs.

BACK TO INDEX

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CADILLAC EMISSION CONTROLS

GENERAL DESCRIPTION

All cars are equipped with various systems to control the emission of pollutants to the atmosphere. A positive crankcase ventilation (P.C.V.) system is used to prevent the emission of crankcase vapors. The air injection reactor system (A.I.R.), used on California and E.F.I. cars only, works to control the concentration of emission of exhaust pollutants. The exhaust gas recirculation system (E.G.R.) is used to reduce oxides of nitrogen emissions from the engine. An evaporative control system (E.C.S.) is also used to retain fuel vapors normally lost due to evaporation in the fuel system.

All cars except Canadian and export vehicles are equipped with a Catalytic Converter system. Since the Catalytic Converter is an integral part of the exhaust system, information on its operation and servicing will be found in Section 8.

The Early Fuel Evaporation Valve (E.F.E.), is installed on all engines except cars equipped with E.F.I. This valve is also an integral part of the exhaust system and its operation is explained in Section 8.

Operating principles and service procedures for these systems are contained in this section.

POSITIVE CRANKCASE VENTILATION SYSTEM (P.C.V.)

The crankcase ventilation system, Fig. 6-161, is designed to prevent contaminating hydrocarbons from escaping to the atmosphere. This is accomplished by routing the vapors from the crankcase through a vacuum controlled ventilating valve on the right rocker arm cover into the intake manifold, where they mix with the air-fuel mixture and are burned in the combustion process.

Air is supplied to the crankcase ventilation system through a crankcase ventilating breather assembly located between the air cleaner and the left rocker arm cover.

The two critical points in this system are the ventilator valve, (PCV) which should be changed every 30,000 miles or 24 months, whichever occurs first, and

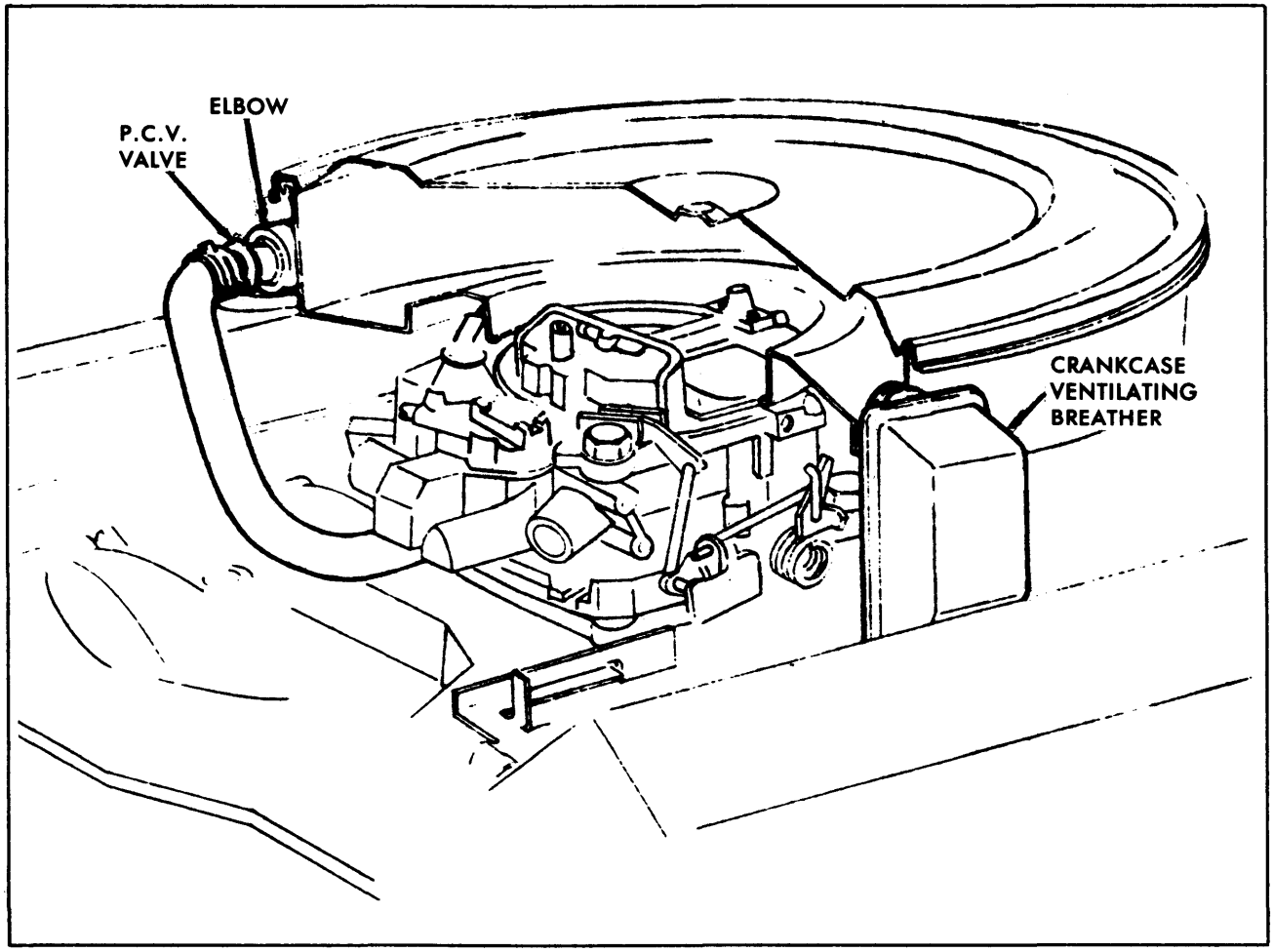


Fig. 6-161 Positive Crankcase Ventilation Valve

BACK TO INDEX

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the crankcase ventilating breather, located on the left rocker arm cover, which should be cleaned every 15,000 miles or 12 months, whichever occurs first. Other components of the system should be inspected, cleaned and or replaced as necessary every 30,000 miles or 24 months, whichever occurs first.

When the engine is operating, air enters the positive crankcase ventilation system through the air cleaner and breather located on the left rocker arm cover. The breather contains the filtering element. The air then flows into the left rocker arm cover and into the valve lifter compartment, and combines with the blow-by gas, and unburned air-fuel mixture. These fumes are drawn through the right rocker arm cover and ventilation valve into the base of the carburetor and intake manifold, where they are mixed with the air-fuel mixture and burned.

The Ventilator valve, Fig. 6-162, is constructed so that it is held closed by spring pressure when the engine is not running. This prevents an accumulation of hydrocarbon laden fumes from collecting in the intake manifold, which could result in hard starting.

As the engine is started, manifold vacuum pulls the valve open against the spring pressure and as long as there is engine vacuum, the valve floats, permitting crankcase fumes to enter the intake manifold. A baffle in the right rocker arm prevents oil from being drawn into the intake manifold through the ventilator valve.

In the event of an engine backfire through the intake manifold the ventilator valve shuts, preventing any flow through it. This action prevents the ignition of fumes in the crankcase.

During certain engine operations where more blow-by is created than the ventilator valve can handle, the excess amount is returned to the air cleaner and to the carburetor by way of the left rocker arm cover and breather assembly and burned in the engine, instead of being released into the atmosphere. The breather assembly acts as a separator to keep oil from being drawn into the air cleaner during this operation.

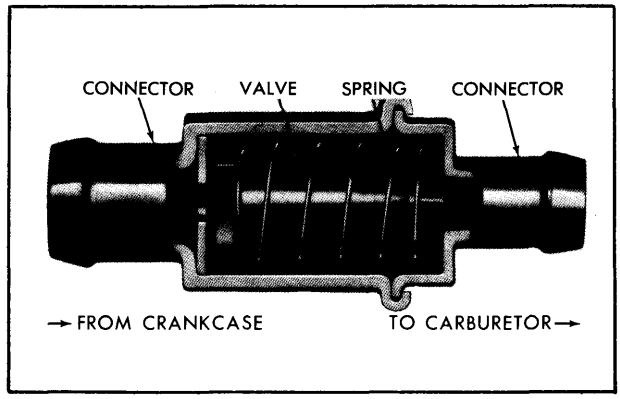


Fig. 6-162 P.C.V. Valve

94. Positive Crankcase Ventilator Valve Replacement (Fig. 6-162)

a. Removal

1. Disconnect valve from rubber elbow on right rocker arm cover.
2. Release hose clamp and hose from ventilator valve grommet.

b. Installation

1. Place a small amount of silicone on both ends of new ventilator valve.
2. Install new valve with smaller end into hose.
3. Secure hose to valve with clamp.
4. Install larger end of ventilator valve to right rocker arm cover grommet.

CRANKCASE VENTILATOR VALVE DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE
Slow, unstable idle, rolling, frequent stalling, breather backflow.	Valve completely plugged, or stuck in backfire (engine off) position.
Engine operation OK, but breather backflow at heavy throttle.	Valve stuck in idle position.
Rough, fast idle. Engine stalls. No backflow.	Valve stuck in intermediate position.

(NOTE: If the valve is inoperative, it should be replaced.)

AIR INJECTOR REACTOR SYSTEM (A.I.R.)

The A.I.R. system of controlling hydrocarbons and carbon monoxide is used on E.F.I. cars, on all vehicles built for sale in the State of California and on the Commercial Chassis when equipped with the 145 amp. generator.

The back-pressure transducer controlled EGR system is used on vehicles equipped with the A.I.R. system. All other vehicles use the EGR System without the back-pressure transducer.

BACK TO INDEX

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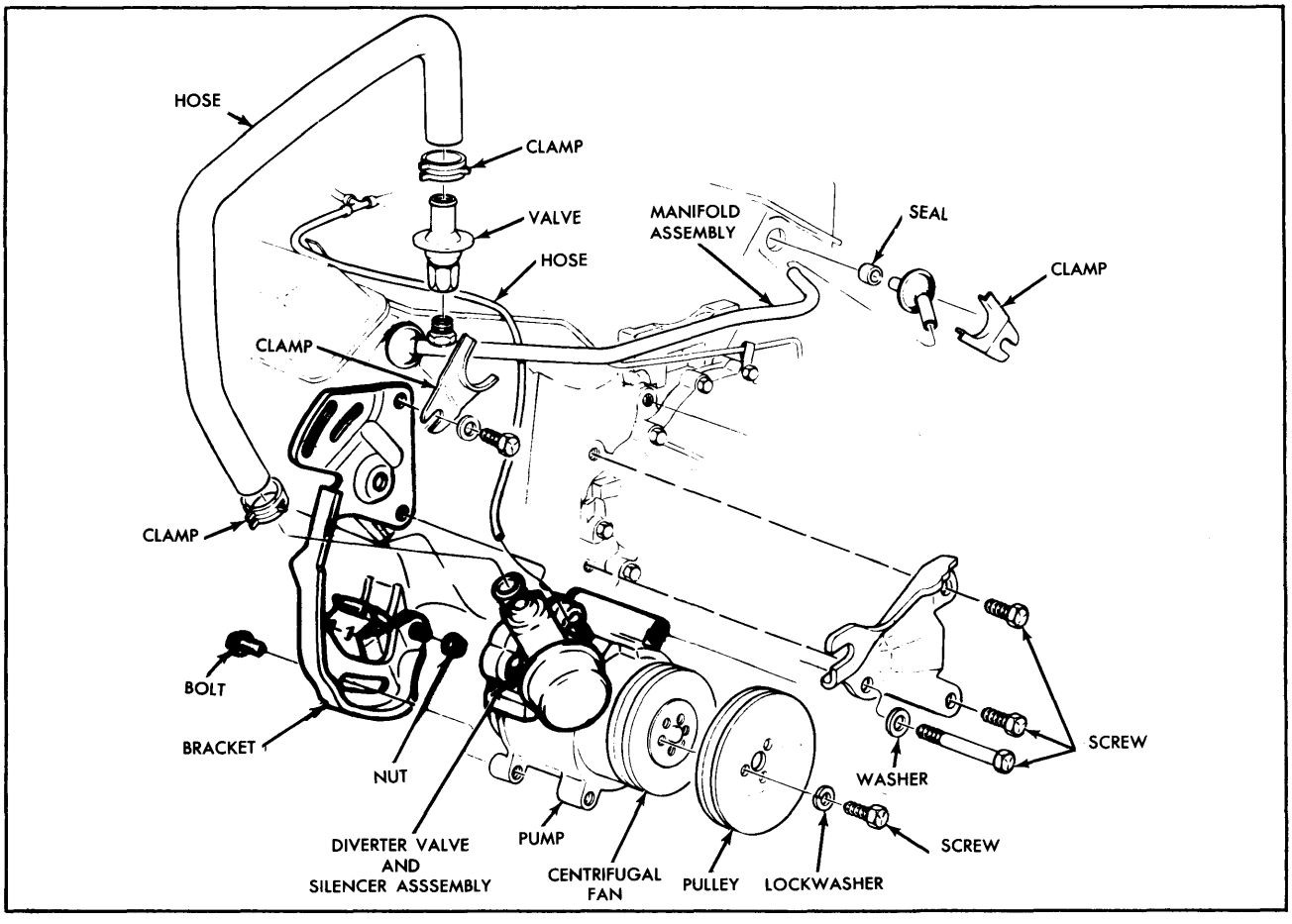


Fig. 6-163 Air Injection Reactor System

The A.I.R. system, Figs. 6-163 and 6-166, reduces the amount of hydrocarbons and carbon monoxide in the exhaust gas by injecting air directly into the exhaust port of each cylinder (except 4 and 5 on E.F.I. cars). The air added to the hot exhaust gases causes further oxidation of the gases before they enter the exhaust manifold.

The A.I.R. system consists of a belt-driven pump located with the front accessory group, a formed rubber air hose, a metal tubing manifold between the cylinder heads, specially designed cylinder heads that incorporate air passages to the rear of the exhaust valves. There is a diverter valve and silencer on the A.I.R. pump to control pressures within the system, and a check valve to protect the hoses and pump from hot gases.

Do not attempt to operate vehicle with drive belt disconnected.

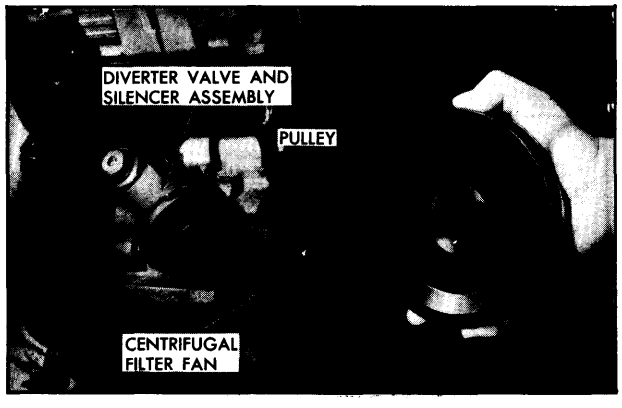


Fig. 6-164 Air Pump

a. Air Pump (Fig. 6-164)

The belt-driven air pump is located at the lower right front of the engine. The pump front mounting bracket is attached to the front of the engine. The pump rear mounting bracket is attached to the cylinder block. Power take-off for the pump is at the crankshaft pulley. Pump speed is 1.20 times crankshaft speed. Intake air passes through a centrifugal fan at the front of the pump, where foreign materials are separated from the air by centrifugal force. Air is delivered to the air injection manifold by a formed flexible hose of three-quarter inch inside diameter fitted to a three-quarter inch exhaust tube on the diverter valve at the side of the pump, hoses are secured to all fittings by clamps.

The only serviceable component of this pump is the centrifugal fan. Do not assume pump is defective if it squeaks when turned by hand. Do not lubricate the pump in any way.

(NOTE: If the engine or underhood compartment is to be cleaned with steam or high-pressure detergent, the centrifugal filter fan should be masked off to prevent liquids from entering the pump.)

BACK TO INDEX

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b. Air Injection Manifold

The air injection manifold is held in the cylinder heads by clamps. These clamps must be installed correctly to insure proper sealing. The right hand side clip, (generator side) should be installed with the flanges pointing away from the cylinder head. The left hand clip should be installed with the flange pointing towards the cylinder head. Each feeder tube of the manifold is sealed by an asbestos and graphite packing gland seal which fits on the tube below the flange.

c. Cylinder Heads

Each cylinder head contains an air passage inboard of the valves with connecting passages at each exhaust valve area (except cylinders 4 and 5 on E.F.I. cars). The passages lead into the exhaust passages directly behind the valves. Main air passages at the front of each cylinder head are counter-bored and chamfered to provide a seat for the feeder tube packing gland. The glands bottom on the chamfered counter-bore shoulders.

d. Carburetor

A Quadrajet M4ME and M4MEA carburetors are specially calibrated for use on Cadillac cars. The idle mixture screws are computer adjusted and sealed at the factory.

e. Diverter Valve (Fig. 6-165)

The diverter valve is attached to the side of the pump. It senses manifold vacuum through a three-sixteenths inch fitting in the intake manifold except E.F.I. cars which sense it at the throttle body. During sudden deceleration an overly rich air/fuel mixture occurs momentarily which can produce objectionable afterfire in the exhaust system. To prevent

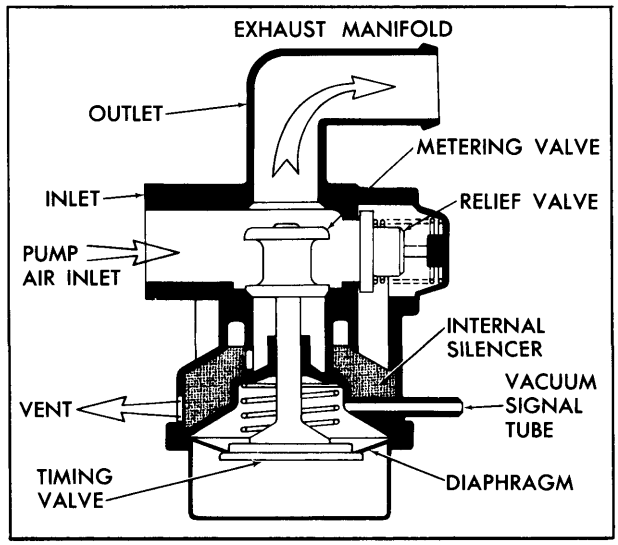


Fig. 6-165 Diverter Valve—Sectional View

A.I.R. PUMP DIAGNOSIS CHART

CONDITION	CAUSE	CORRECTION
Excessive Belt Noise	Loose belt. Seized pump.	Tighten belt. Replace pump.
Excessive Pump Noise, Chirping, Rumbling or Knocking	Leak in hose. Loose hose. Hose touching other engine parts. Diverter valve failure. Check valve failure. Pump mounting fasteners loose. Centrifugal fan damaged. Pump failure. Cup plug missing from cover.	Locate source of leak and correct. Reassemble and replace hose clamp. Adjust hose position. Replace valve. Replace valve. Retorque all mounting screws. Replace centrifugal fan. Replace pump. Replace plug.
No air supply.	Loose belt. Leak in hose. Leak at hose fitting. Diverter valve failure. Check valve failure. Pump failure.	Tighten belt. Locate source of leak and correct. Reassemble and replace hose clamps. Replace valve. Replace valve. Replace pump.

BACK TO INDEX

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this possibility of afterfire the diverter valve senses the sudden engine vacuum increase and an internal spool valve closes off air from the air pump being injected into the exhaust system and opens a passage to momentarily divert air through the valve and silencer to atmosphere. Approximate duration of the valve openings is four seconds. This valve also controls pressure within the system by relieving excessive pump output to the atmosphere through the silencer.

f. Check Valve

The air injection manifold is fitted with a screw-on check valve near the right cylinder head. This valve has a one-way diaphragm which prevents hot exhaust gas from backing up into the hose and pump and causing damage. This will protect the system in the event of pump belt failure, abnormally high exhaust system pressure, or air delivery hose ruptures.

g. Thermac Air Cleaner—Except E.F.I. (Fig. 6-166)

A thermac air cleaner assembly is installed to reduce the amount of carbon monoxide in the exhaust gases. This reduction is accomplished by regulating the temperature of the air at the air cleaner inlet.

The thermac air cleaner assembly includes a temperature sensor, vacuum motor, control damper assembly and connecting vacuum hoses. The vacuum motor, controlled by the temperature sensor, operates the air control damper assembly to control the flow of preheated air (from a heat shield around the exhaust manifold) or non-preheated (underhood) air.

The thermac air cleaner is designed to maintain a minimum air temperature of 105°F (41°C) entering the carburetor. By maintaining this minimum temperature, the carburetor is calibrated to minimize exhaust emissions.

If the temperature of the air entering the air cleaner, (Fig. 6-167), is 85°F. (19°C) or below, the temperature sensor is closed to allow engine vacuum to be directed to the vacuum motor closing the damper assembly to outside air. With the damper closed, underhood air will flow through the openings at the ends of the exhaust manifold heat shield where it is heated by the exhaust manifold. This preheated air then flows up through the heat tube to the air cleaner. This is the hot air delivery mode.

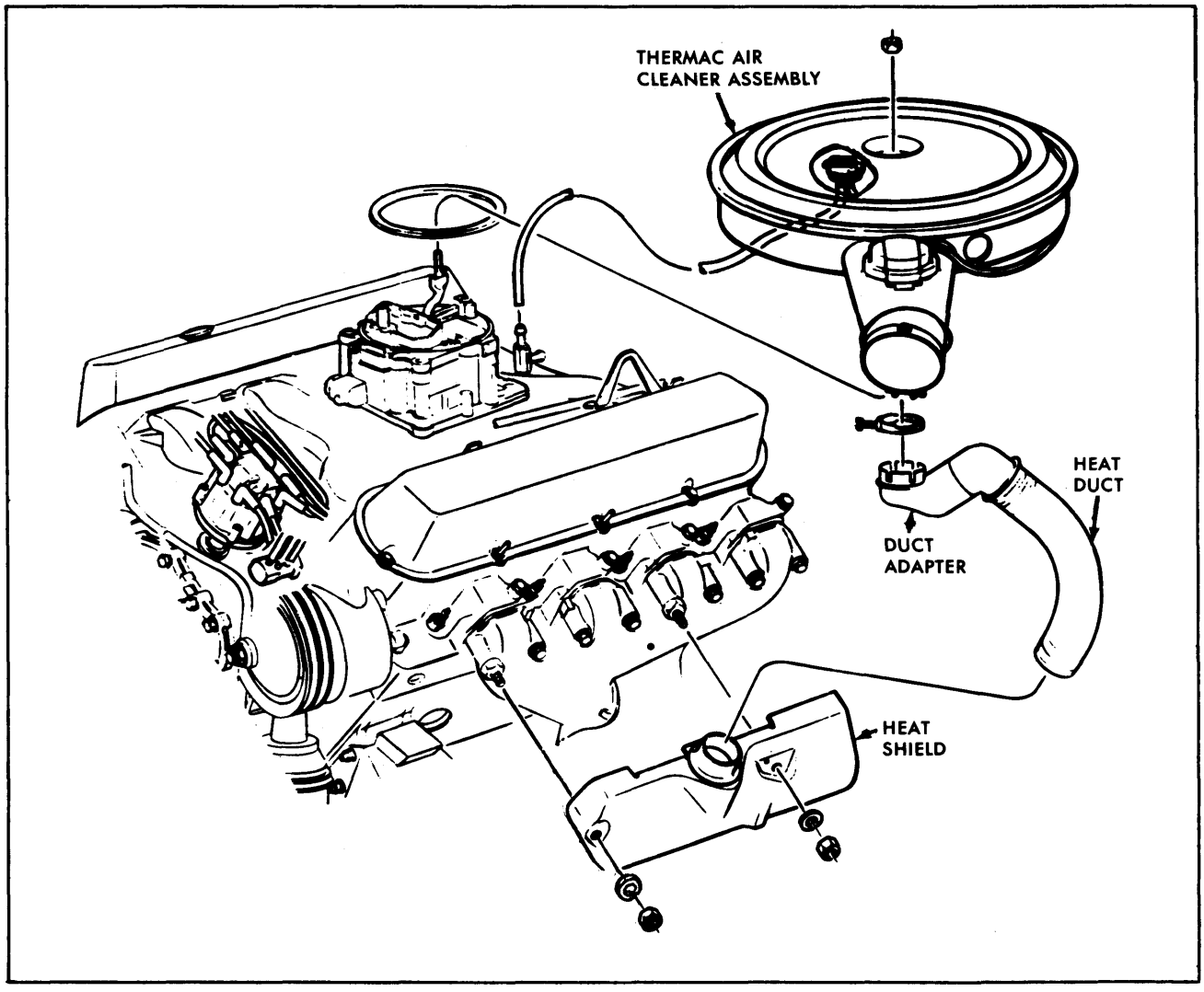


Fig. 6-166 Thermac Air Cleaner—Except E.F.I.

BACK TO INDEX

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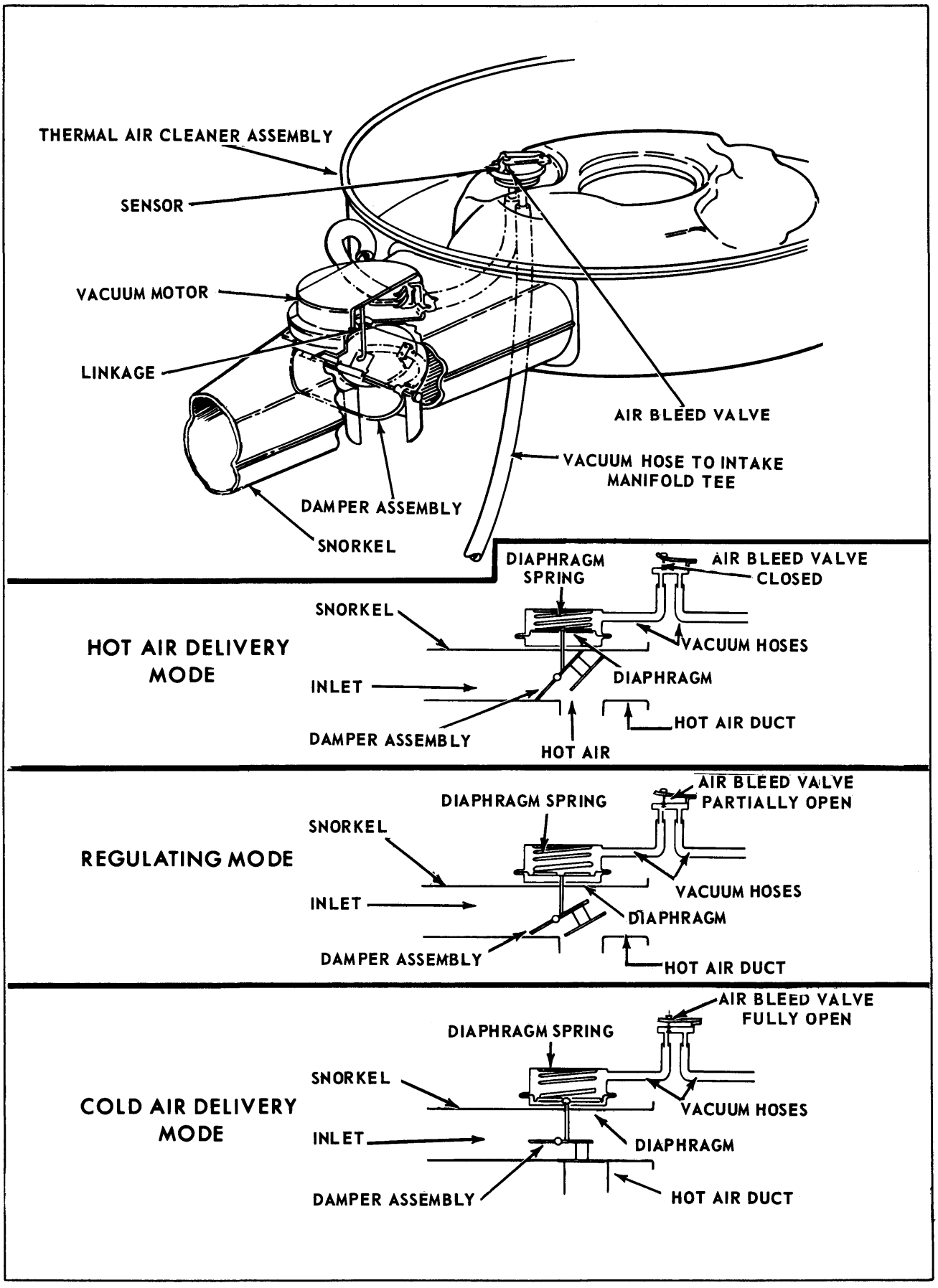


Fig. 6-167 Thermac Air Cleaner Operation—Except E.F.I.

BACK TO INDEX

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As the temperature inside the air cleaner reaches approximately 100°F (38°C), the sensor valve begins to open and bleed off vacuum from the vacuum motor. This allows the vacuum motor diaphragm spring to partially open the damper, allowing underhood air to be mixed with the heated air to keep the intake air temperature at approximately 100°F (38°C). Under full throttle conditions (less than 4-6" H.G.) the vacuum will no longer hold the valve open to hot air. Diaphragm spring pressure closes the hot air pipe allowing only "cool" air to enter the carburetor.

During a "no vacuum or engine off condition", the damper will be positioned to close heat tube.

95. Testing Thermac Air Cleaner

1. Check heat tube and vacuum hoses for condition and secure connections. Repair or replace as required before further testing.
2. With engine off, remove air cleaner cover and tape Thermometer, J-5421, to air cleaner base next to sensor.
3. Allow a short time for thermometer reading to stabilize. Read thermometer and proceed on following basis: If temperature is below 80°F (26°C), continue with step 4. If temperature is above 80°F (22°C), remove air cleaner and allow it to cool to approximately 75°F (22°C).
4. Install a vacuum gage in the vacuum line between sensor and vacuum motor.
5. Check position of control damper by looking in end of snorkel. Damper should be open.
6. Install cover on air cleaner without nut and start engine.
7. If ambient temperature is above 85°F (30°C), proceed to step 10.
8. If ambient temperature is below 85°F (30°C), observe position of damper in snorkel. When damper begins to move toward the open (outside air) position, immediately remove air cleaner cover and record temperature and vacuum readings.
9. Replace air cleaner cover and continue watching damper.
10. If ambient temperature has risen above 85°F (30°C), it is only necessary to make sure damper is completely open by 105°F (41°C). When damper moves to full open position, again remove air cleaner cover and record temperature and vacuum readings.
11. Compare readings obtained in steps 8 and 10 with following chart:

Damper Position	Temperature Reading	Vacuum Reading in Hg.
Starts to Open	85°F (30°C)	Full
Full Open	105°F (41°C)	4"-6"

12. Replacement of thermac air cleaner components should be based on following information.

a. If temperature is within specifications, thermac air cleaner is functioning properly.

b. If temperature is out of specification, but vacuum is correct, replace sensor as described in Note 100.

c. If damper does not open at correct temperature, proceed to Step 13.

13. With engine at idle speed, disconnect damper assembly vacuum hose at sensor unit. Damper door should move to open (outside air) position. If damper does not open, check linkage for a binding condition.

14. Reconnect damper assembly vacuum hose with engine at idle speed. With vacuum gage reading of at least 9 in. Hg. (connect to manifold vacuum fitting if sensor is open) damper door should close snorkel passage (hot air position). If damper does not close, there is a vacuum leak in the vacuum motor diaphragm. Replace vacuum motor as described in Note 101.

96. A.I.R. System Check Valve

a. Inspection

1. The check valve should be inspected whenever the hose is disconnected from the check valve or whenever check valve failure is suspected. (A pump that had become inoperative and had shown indications of having exhaust gases in the pump would indicate check valve failure.)
2. Blow through the check valve (toward the cylinder head) then attempt to suck back through check valve. Flow should only be in one direction (toward the air manifold).

b. Removal

1. Release clamp and disconnect air hose from check valve.
2. Unscrew check valve from manifold fitting.

c. Installation

1. Screw check valve onto manifold fitting.
2. Position air hose on check valve and secure with clamp.

97. A.I.R. System Diverter Valve (Fig. 6-163)

a. Inspection

1. Check condition and routing of all lines especially the signal line. All lines must be secure, without crimps and not leaking.
2. Disconnect signal line at valve. A vacuum signal must be available with engine running. Reconnect signal line to valve.
3. With engine stabilized at idle speed, no air should be escaping through the silencer. Manually open and quickly close the throttle, a momentary blast of air should discharge through silencer for at least one second.
4. Defective valves should be replaced.

BACK TO INDEX

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b. Removal

1. Disconnect vacuum hose from diverter valve.
2. Release clamp and remove air hose from fitting on diverter valve.
3. Remove two screws securing diverter valve to pump and remove diverter valve assembly.
4. Remove gasket material from diverter valve and pump flanges.

c. Installation

1. Position new gasket on pump flange.
2. Position diverter valve on pump flange and secure with two screws.
3. Connect air hose to diverter valve fitting and secure with clamp.
4. Connect vacuum hose to fitting on diverter valve.

98. A.I.R. Pump Centrifugal Filter Fan (Fig. 6-164)

The centrifugal filter fan should not be cleaned, either with compressed air or solvents.

CAUTION: Centrifugal fan should not be removed from pump unless it is damaged, as removal procedures will destroy impeller.

a. Removal

1. Remove pump drive belt.
2. Remove three screws and rewmove pump pulley, Fig. 6-163.
3. Break remaining portion of centrifugal fan off pump hub, being careful that fragments do not enter air intake hole.

b. Installation

1. Position new centrifugal fan on pump hub.
2. Position pump pulley against centrifugal fan.
3. Install three pulley screws and tighten equally to 60 inch-pounds. This will press centrifugal fan onto pump hub. Do not drive centrifugal fan on with hammer.

(NOTE: The slight amount of interference with the housing bore is normal. After a new fan has been installed, it may squeal upon initial operation or until its O.D. sealing lip has worn in. This may require a short period of pump operation at various engine speeds.)

4. Install pump drive belt.
5. Adjust drive belt tension as described in Note 10.

99. A.I.R. Pump

Servicing of this pump should be limited to replacement of the entire pump. Do not open pump for any reason. Do not clamp it in a vise or use a hammer or pry bar on the pump housing. If pry bar is used during belt tensioning, pry as close to rear of pump cover as possible.

a. Inspection

Accelerate engine to approximately 1500 RPM and observe air flow from hose. If air flow increases as engine is accelerated, pump is operating satisfactorily. If air flow does not increase or is not present, proceed as follows:

1. Check for proper drive belt tension.
2. Check for a leaky pressure relief valve. Air may be heard leaking with the pump running.

(NOTE: The A.I.R. System is not completely noiseless. Under normal conditions noise rises in pitch as engine speed increases. To determine if excessive noise is the fault of the Air Injection Reactor System, operate the engine with the pump drive belt removed. If excessive noise does not exist with the belt remove proceed as follows:)

3. Check for a seized Air Injection Pump.
4. Check hoses, tubes and all connections for leaks and proper routing.
5. Check air injection pump for proper mounting.
6. If none of the above conditions exist and the air injection pump has excessive noise remove and replace pump unit.

b. Removal

1. Raise car and place on jack stands.
2. Remove air hose from diverter valve.
3. Disconnect vacuum line from fitting on diverter valve.
4. Remove three screws securing pulley to pump and remove pulley and belt.
5. Remove mounting bolt at top of air pump.
6. Remove adjusting bolt from bottom rear of pump and remove pump and diverter valve as an assembly.

c. Installation

1. Lift pump up through space between lower radiator hose and oil filter. Rotate pump so that diverter valve passes over oil filter.
2. Position pump against mounting bracket and loosely install upper screw.
3. Loosely install adjusting bolt at lower rear of pump.
4. Install pulley and drive belt. Adjust drive belt as described in Note 10.
5. Tighten both mounting and adjusting screws to 25 foot-pounds.
6. Connect air hose to larger fitting of diverter valve and secure with clamp.
7. Install vacuum hose to small fitting on diverter valve.

100. Thermac Air Cleaner Temperature Sensor

a. Removal

1. Detach hose between sensor and manifold fitting and remove air cleaner from engine.
2. Remove hose between sensor and vacuum motor, Fig. 6-168.
3. Pry retainer away from sensor vacuum fittings and remove retainer.
4. Note position of sensor and remove sensor with gasket from position in air cleaner.

BACK TO INDEX

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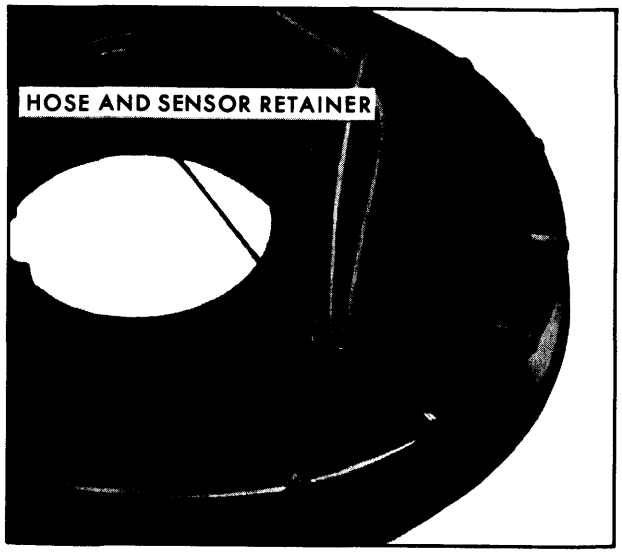


Fig. 6-168 Thermac Air Cleaner Sensor Hoses

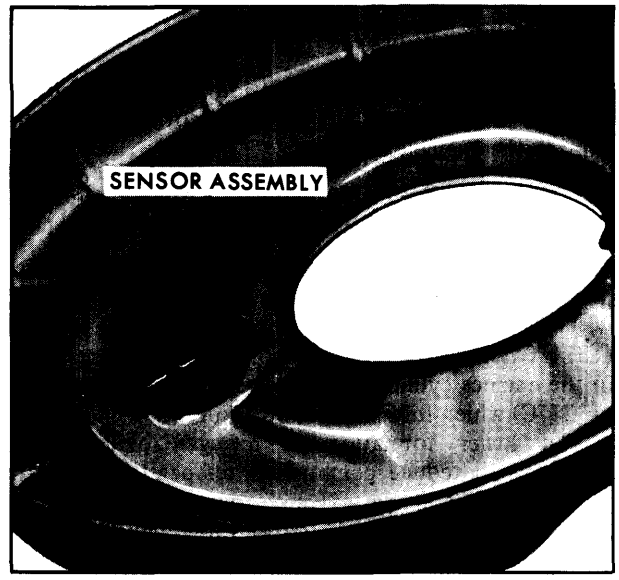


Fig. 6-169 Positioning Thermac Air Cleaner Sensor

b. Installation

1. Install gasket on sensor and install sensor to air cleaner in original position, Fig. 6-169.
2. Press retainer on vacuum connections.
3. Connect vacuum hose between sensor and vacuum motor. Install vacuum hose to remaining fitting.
4. Install air cleaner, making sure heat tube engages heat shroud on exhaust manifold.
5. Connect vacuum hose between sensor and manifold fitting.

101. Thermac Air Cleaner Vacuum Motor

a. Removal

1. Disconnect hose between sensor and manifold fitting and remove air cleaner from engine.
2. Disconnect vacuum hose between motor and sensor.
3. Drill a 1/16" hole in the center of each spotweld holding vacuum motor to snorkel. Enlarge hole as necessary to remove retainer.
4. Remove retainer and lift motor slightly off air cleaner.
5. Twist motor to one side to disengage link from valve and remove motor.

b. Installation

1. Install link in valve and position motor on air cleaner snorkel.
2. Position retainer strap over motor and secure with two sheet metal screws.
3. Check operation of valve to see that screws do not interfere.
4. Connect vacuum hose between motor and sensor. Install vacuum hose on remaining fitting.
5. Install air cleaner, making sure heat tube engages heat shroud on exhaust manifold.
6. Connect vacuum hose between sensor and manifold fitting.

102. Thermal Vacuum Switch

a. TVS Operation — Federal Carburetor

The two port TVS, located in the upper left front of the cylinder block, allows manifold vacuum to the EFE valve below approximately 150°F. (66°C.) (120°F. (50°C.) on California cars) coolant temperature. Intake manifold vacuum closes the EFE valve, forcing the exhaust gases through the crossover passage, in the intake manifold to quickly warm it for better fuel vaporization. At approximately 150°F. (66°C.) (120°F. (50°C.) on the California cars) coolant temperature, the TVS changes position, blocks off manifold vacuum and allows the EFE valve to open resulting in normal flow of gases through the exhaust system.

b. TVS Operation — California Carburetor (System on California Cars Only)

A 5-port TVS is used to perform the above functions plus preventing ported vacuum from reaching the EGR thermal vacuum valve below approximately 120°F, (50°C.) coolant temperature. At this point the TVS opens to ported vacuum which allows normal EGR thermal vacuum valve operation.

Use of the TVS effectively blocks EGR valve operation even though the thermal vacuum valve is open.

c. TVS Operation — All E.F.I.

The TVS on electronic fuel injected car has three fittings; one to manifold vacuum, one to ported vacuum above the throttle valves and one to the distributor vacuum diaphragm. At coolant temperatures above 220°F (97°C.), this valve switches from ported vacuum to manifold vacuum, advancing the ignition timing to full vacuum advance at idle. This reduces the possibility of engine overheating under extremely high temperature operation.

BACK TO INDEX

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EXHAUST GAS RECIRCULATION (E.G.R.)

The Exhaust Gas Recirculation system (E.G.R.) is used on all engines to reduce oxides of nitrogen emissions in the engine exhaust.

(NOTE: For vehicles equipped with E.F.I. refer to Electronic fuel injection Section of this Manual.)

During the combustion process nitrogen, which makes up 80 percent of the air, will tend to combine with oxygen at temperatures above 2500 degrees (1371°C). During the combustion process, temperatures in the engines cylinders will go well above 2500 degrees (1371°C) which forms oxides of nitrogen.

To lower formation of nitrogen oxides, it is necessary to reduce combustion temperatures. This is done by introducing exhaust gases into the engine cylinders with the air fuel mixture for combustion.

The E.G.R. valve is mounted at the rear of the intake manifold, Fig. 6-170. Exhaust gas from the exhaust crossover is metered by the E.G.R. valve into an intake passage permitting flow into the cylinders.

Operation (Except E.F.I.)

(NOTE: For information on E.F.I. refer to the E.F.I. portion of this section.)

The E.G.R. Valve, Fig. 6-171 is operated by ported vacuum. It is fully closed with vacuum less than 2 inches; it opens between 2 inches and 7" Hg; and is fully open with more than 7" Hg of vacuum. At idle and wide open throttle ported vacuum is low, the valve is closed and recirculation does not occur. At part throttle ported vacuum is high, the valve is open and exhaust gas recirculation is at maximum.

All engines use a temperature sensitive control valve in the vacuum signal line to the E.G.R. valve.

The valve is closed below 64.5° + 3.5°F (19° ± 1°C) engine metal temperature blocking vacuum to the E.G.R. valve giving better driveaway when the engine is cold.

The E.G.R. control valve is open above 76°F. (25°C.) engine metal temperature allowing E.G.R. ported vacuum to be directed to the E.G.R. valve.

103. E.G.R. Valve Functional Check

1. Remove air cleaner assembly and plug manifold vacuum fitting.
2. Remove vacuum hose from distributor and plug.
3. Install tachometer.
4. Remove E.G.R. hose from E.G.R. valve and plug hose.
5. With A/C "Off", drive wheels blocked and transmission in park, start engine and bring to operating temperature. Put cam follower on second step of fast idle cam and note engine speed.
6. Attach a vacuum hose between the air cleaner vacuum port on the intake manifold and the E.G.R. valve or use external vacuum source of at least 5 inches. Diaphragm of E.G.R. valve should rise and engine speed should drop at least 250 R.P.M.
7. If engine speed does not drop as specified in Step 6, remove carburetor and clean the intake manifold E.G.R. ports and E.G.R. valve assembly as described in Notes 105 and 106. After cleaning, recheck function per Steps 5 and 6, if engine speed does not drop as specified, replace E.G.R. valve assembly.
8. Remove tachometer, connect distributor vacuum hose, E.G.R. vacuum hose and install air cleaner assembly.

104. E.G.R. Control Valve Functional Check

The E.G.R. bi-metal valve is closed below 64.5° ± 3.5°F (19° ± 1°C) engine metal temperature blocking vacuum to the E.G.R. valve giving better driveaway when the engine is cold.

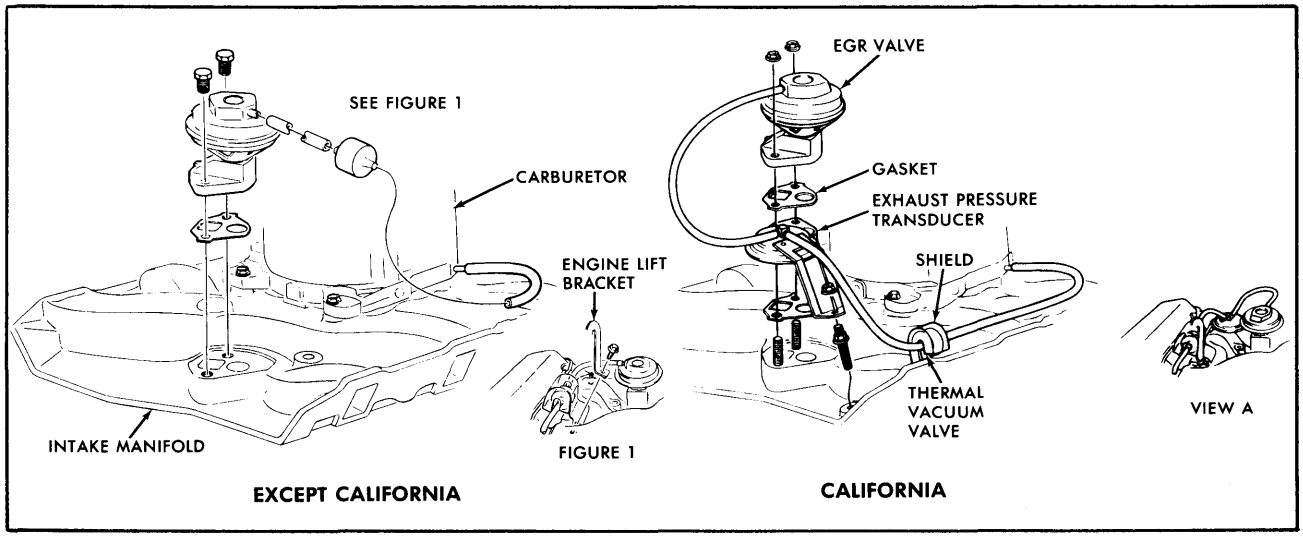


Fig. 6-170 E.G.R. Systems

BACK TO INDEX

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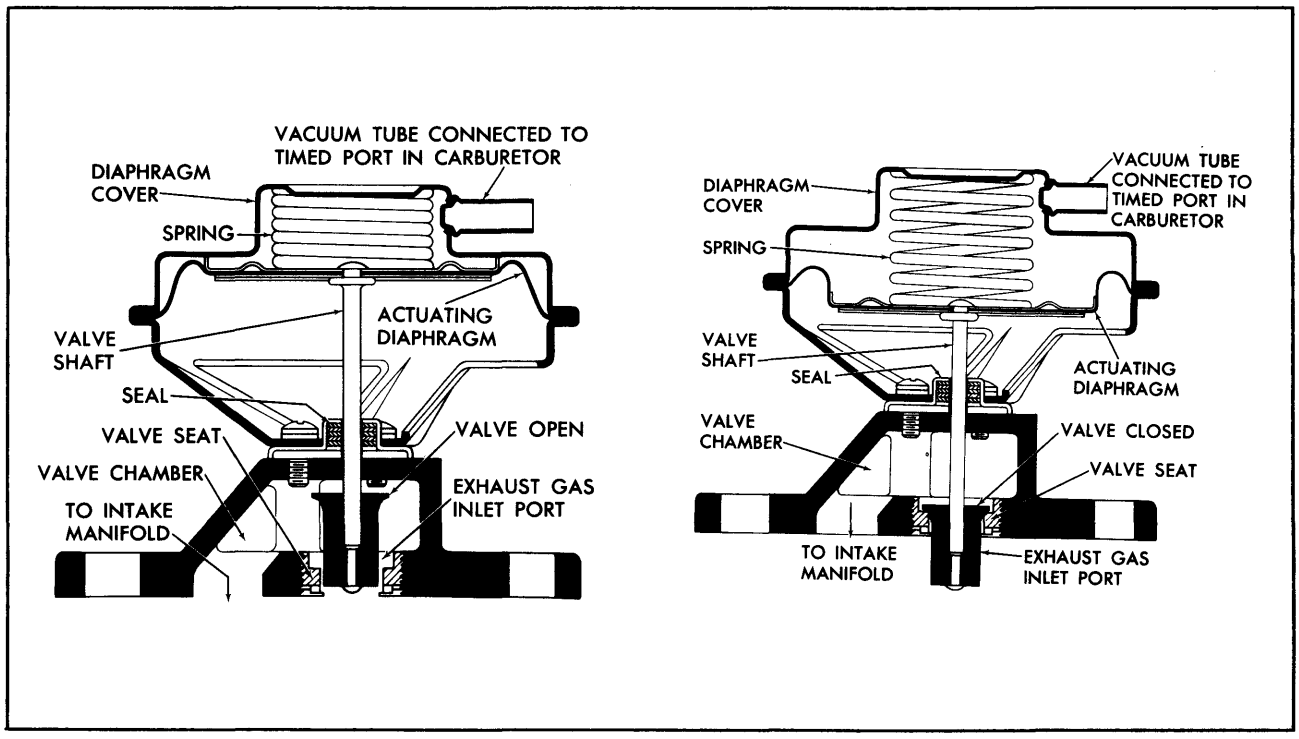


Fig. 6-171 E.G.R. Valve Operation

The E.G.R. bi-metal valve is open above 76°F (25°C) engine metal temperature allowing E.G.R. ported vacuum to be directed to the E.G.R. valve.

To check the operation of the valve it is necessary to lower its temperature below the 64.5° ± 3.5°F (19° ± 1°C) change over point. This may be accomplished by exposing the valve to a cold air stream or by application of electronic circuit cooler to the exterior surfaces of the valve. Do not direct the cooling medium inside the valve. Check valve operation by applying oral vacuum to the valve at room temperature (above 60°F (15°C) and in its cooled (below 60°F (15°C) state. Valve should block air flow when cold and pass air when warm.

105. E.G.R. Valve Cleaning (Fig. 6-172)

CAUTION: Do not wash valve assembly in solvents or degreaser permanent damage to valve diaphragm may result.

1. Remove vacuum hose from E.G.R. Valve Assembly.

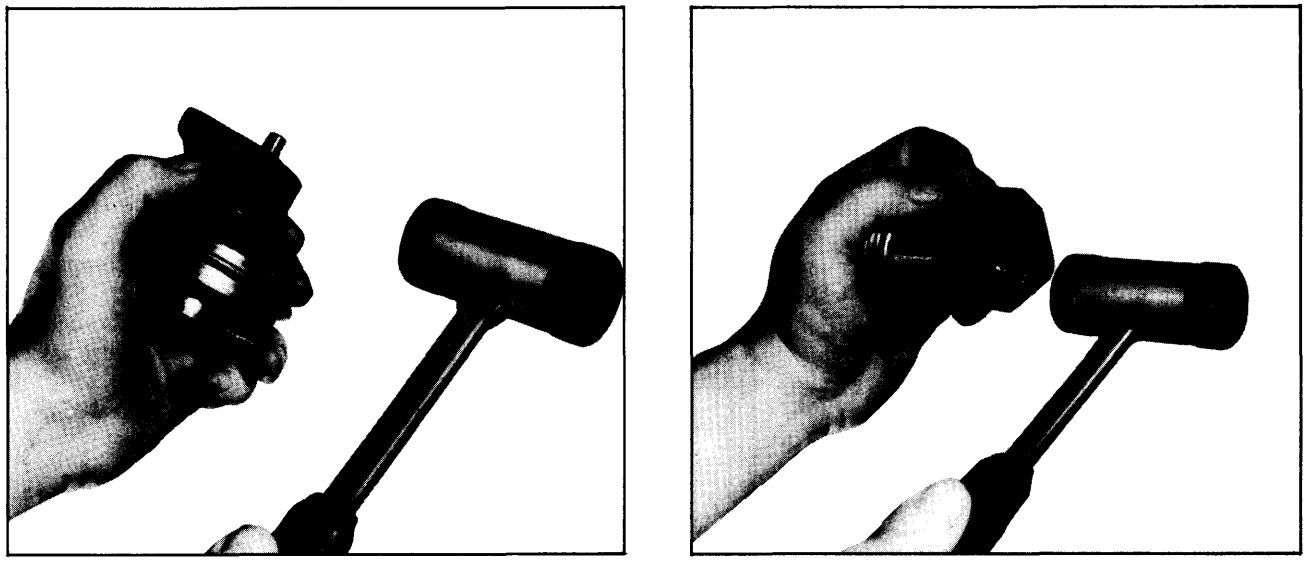


Fig. 6-172 Cleaning E.G.R. Valve

BACK TO INDEX

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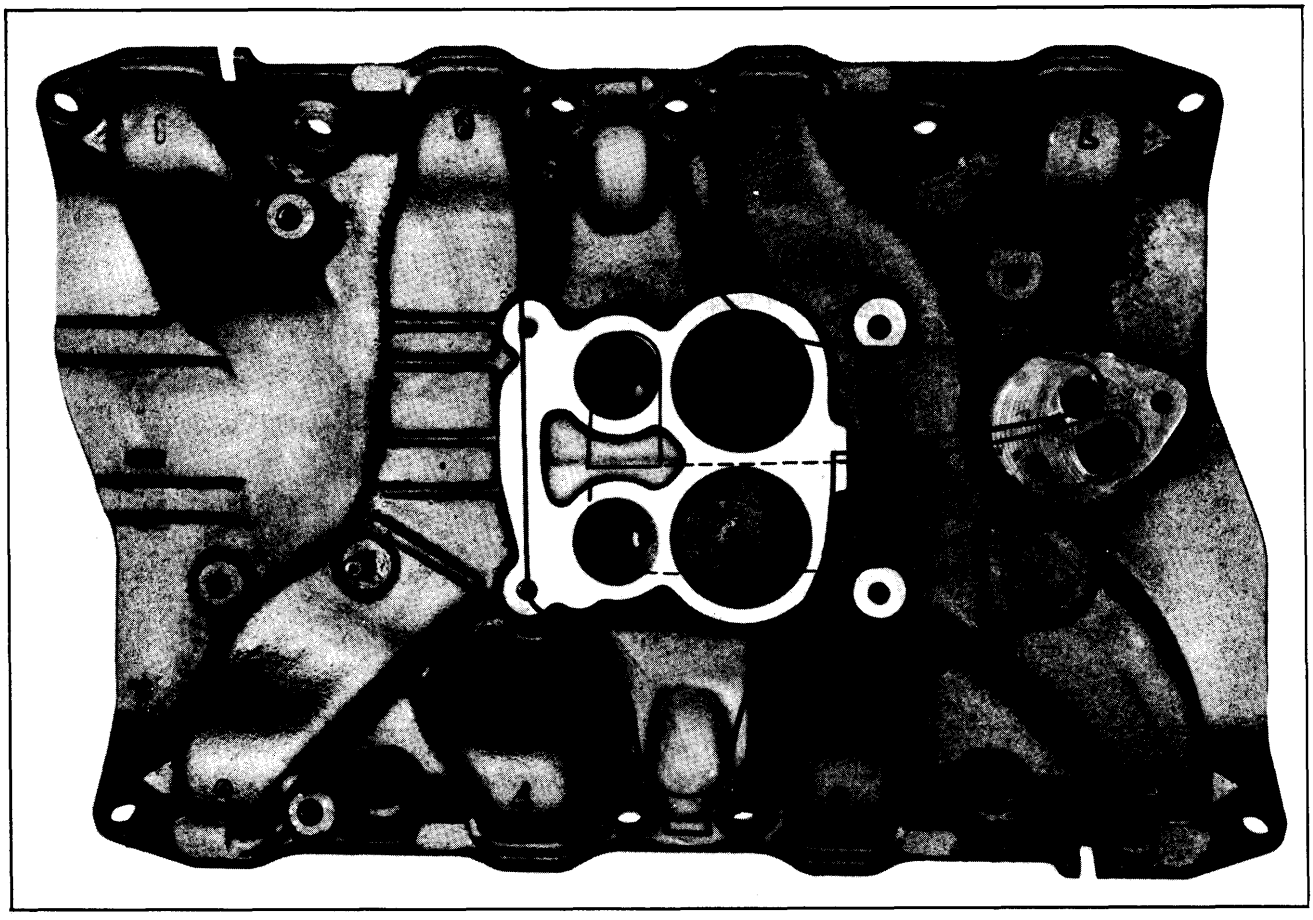


Fig. 6-173 E.G.R. Passages in Intake Manifold

2. Remove two attaching nuts and E.G.R. Valve Assembly from intake manifold, discard gasket.

3. Hold the valve assembly in hand, then tap lightly on the sides and end of the valve with a small plastic hammer to remove the exhaust desposits from the valve seat, Fig. 6-172. Empty loose particles. DO NOT PUT IN A VISE.

4. With a wire wheel, buff the exhaust deposits from the mounting surface and around the valve.

5. Depress the valve diaphragm and look at the valve seating area through the valve outlet for cleanliness. If valve or seat are not completely clean, repeat Step 3.

6. Look for remaining exhaust deposits in the valve outlet and seat area. Remove deposit build up with a screwdriver or other suitable sharp tool.

7. Clean mounting surfaces of intake manifold and valve assembly, then using a new gasket install the valve assembly to the intake manifold. Torque the nuts to 10 ft. lbs.

8. Check all Vacuum lines for splitting, kinks, or obstructions.

9. Connect the vacuum hose.

106. E.G.R. Port Cleaning (Fig. 6-173)

1. Remove carburetor as described in note 43.

2. Remove vacuum hose from E.G.R. valve.

3. Remove two E.G.R. attaching nuts and E.G.R. valve assembly from intake manifold, discard gasket.

4. Tape the forward hole, in the manifold on E.G.R. valve assembly mounting pad.

5. Remove the deposits from the intake manifold E.G.R. ports (in the manifold under the carburetor primary valve area) by HAND, using a 9/16" drill bit then a screwdriver to clean the holes and chamfer. DO NOT USE AN ELECTRIC DRILL.

6. Brush any small particles down the two ports into the E.G.R. passage.

7. Plug the left E.G.R. port and using compressed air, blow through the right port.

8. Plug the right E.G.R. port and blow through the left E.G.R. port. Remove tape from E.G.R. valve assembly mounting surface.

9. Clean and install E.G.R. valve (see Note 105).

10. Install carburetor as described in Note 43.

BACK TO INDEX

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EXHAUST PRESSURE TRANSDUCER

An exhaust pressure transducer is used on all E.F.I. cars, all cars built for sale in the state of California (due to the lower No_X limits in that state) and on the commercial chassis (6ZZ) when equipped with the 145 amp. generator, fig. 6-174. The transducer is used in addition to the EGR valve and the thermal vacuum valve.

Operation

The transducer receives its exhaust pressure signal from a small tube leading to the spacer under the E.G.R. valve. In order for the transducer to receive the proper exhaust signal, the holes in the end of the signal tube must be open and clear. Cleaning of this area is required whenever the E.G.R. valve is cleaned.

The transducer is also connected to the E.G.R. vacuum port in the carburetor throttle body (through the thermal vacuum valve). This source vacuum is modulated by the transducer and the resulting vacuum actuates the E.G.R. valve.

The exhaust signal is imposed on the bottom side of the transducer diaphragm while the upper side is exposed to atmospheric pressure through the slots and air filter on top of the housing. A light spring provides a small preload opposing the exhaust pressure signal holding the transducer valve open.

At idle the exhaust pressure is low and the vacuum is nil resulting in no E.G.R. valve operation.

At a slightly greater air flow, the vacuum source is equal to manifold vacuum, but the exhaust pressure is not sufficient to overcome the transducer spring force and the vacuum source is bled off leaving the E.G.R. valve closed.

At some still greater airflow, the exhaust pressure will be great enough to overcome the spring force and close the transducer bleed valve. Now, the vacuum signal is routed to the E.G.R. valve to force it open.

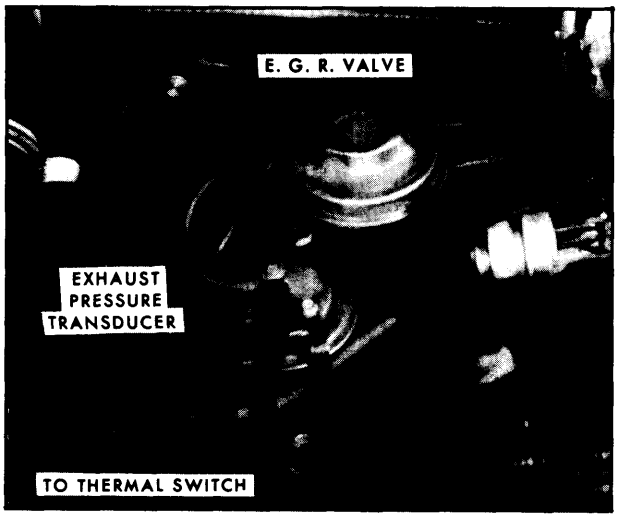


Fig. 6-174 Exhaust Pressure Transducer

Once the E.G.R. valve opens, the exhaust pressure decreases because of the exhaust gases flowing into the intake manifold vacuum through the E.G.R. passage. In actual operation the system will reach a balanced condition providing optimum E.G.R. operation.

Any increase in engine load will momentarily increase the exhaust signal causing the transducer bleed valve to close allowing a stronger vacuum signal to the E.G.R. valve resulting in greater E.G.R. flow. The system will re-stabilize at a greater E.G.R. flow.

At maximum engine load, manifold vacuum, which provides the vacuum source, will be nearly zero, therefore, in spite of high exhaust pressures, there will be no E.G.R. operation.

EVAPORATIVE CONTROL SYSTEM (E.C.S.)

A fuel tank evaporative control system (E.C.S.), Fig. 6-175, is used to prevent emission of fuel vapors from the vehicle fuel system. This is accomplished by venting the fuel tank through a canister containing charcoal.

The fuel tank dome, Fig. 6-175 collects vapors and allows them to pass into a line connected to the charcoal canister, Fig. 6-176 which is mounted on the left rear of the radiator cradle. The canister absorbs fuel vapors in a bed of activated charcoal and retains them until the canister is purged or cleared by air drawn through the bottom of the canister into the carburetor. The absorbing occurs when the vehicle is parked and the purging or cleaning of the charcoal bed occurs when the engine is operated.

The only service normally required for the E.C.S. system is to replace the filter located in the bottom of the canister each 24 months or 30,000 miles. More frequent replacement of the element may be necessary if the vehicle is frequently driven in dusty areas.

CAUTION: The hoses used in this system are specially manufactured and if replacement becomes necessary it is important to use only hose marked "EVAP" or "GM-6107-M" on the hose.

107. Evaporative Control System Vapor Storage Canister

a. Removal

1. Remove two hoses from top of canister. Canister is located on back of radiator cradle just to the left of the radiator.
2. Remove one screw holding canister strap type bracket to radiator cradle.
3. Remove strap and canister from position on cradle.

BACK TO INDEX

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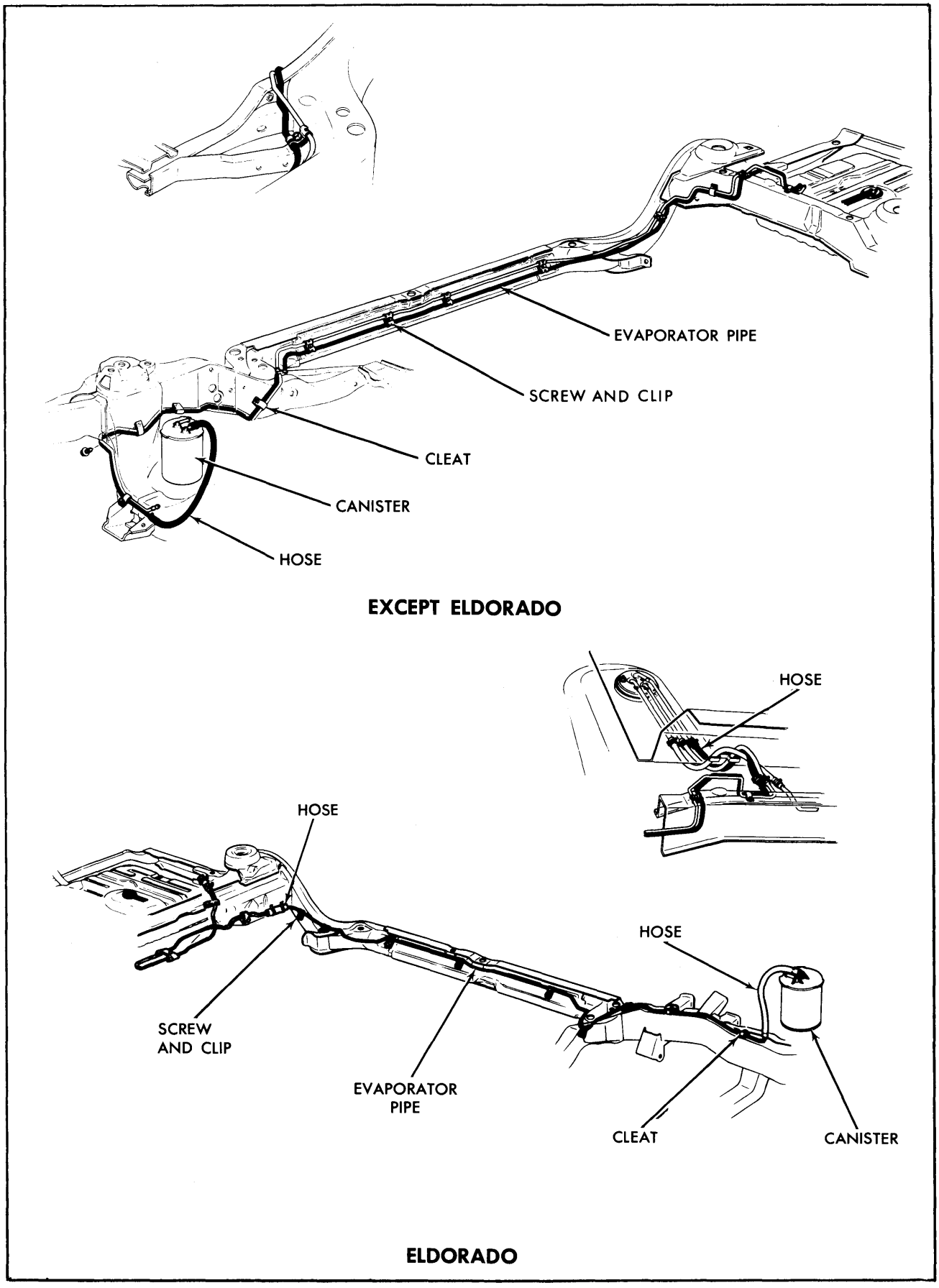


Fig. 6-175 Evaporative Control System

BACK TO INDEX

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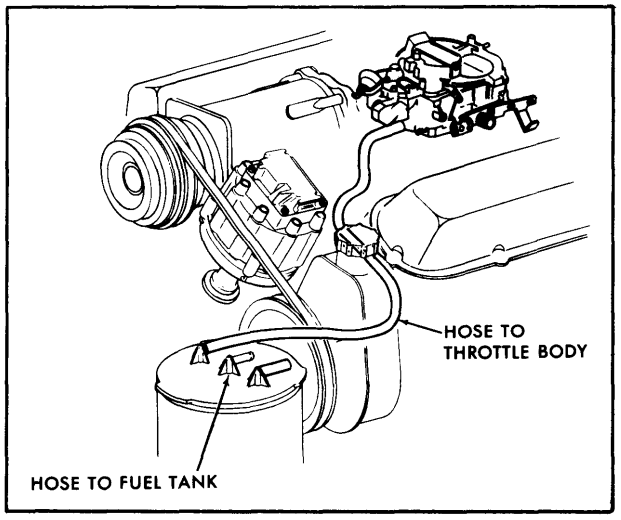


Fig. 6-176 Evaporative Canister Hoses

b. Installation

1. Position canister on bracket behind radiator cradle with two fittings on top facing towards engine.
2. Secure strap around canister with one screw.
3. Connect two hoses to top of canister; small diameter hose to carburetor, large diameter hose to tank.

108. Evaporative Control System Vapor Storage Canister Filter (Fig. 6-177)

a. Removal

1. Remove canister from position on radiator cradle as described in Note 107a.
2. Remove filter element by squeezing out from under retainer bar, Fig. 6-177.

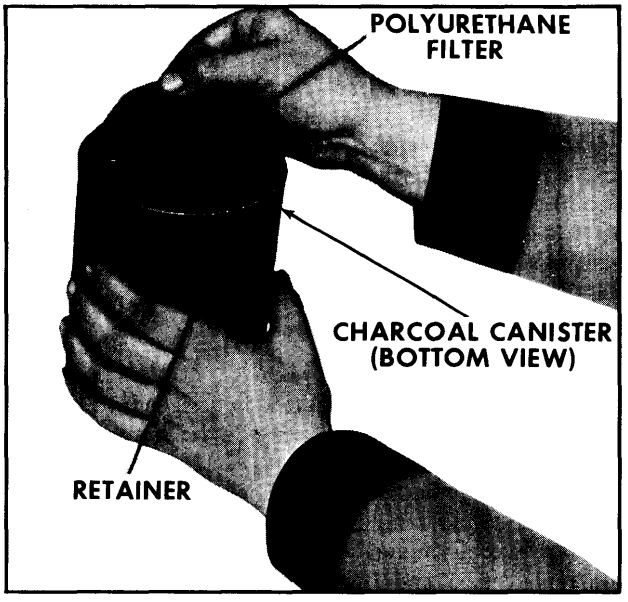


Fig. 6-177 Removing Canister Filter

b. Installation

1. Squeeze element under retainer bar and position evenly around entire bottom of canister. Tuck edges under lip of canister.
2. Install canister in position on radiator cradle as described in Note 107b.

BACK TO INDEX
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GENERAL DESCRIPTION

The engine in all Cadillac cars is of the overhead valve, 90° V-8 design. On all cars (except Seville) the cylinder bore diameter is 4.300 inches and the piston stroke is 4.304 inches, providing a piston displacement of 500 cubic inches. The engine has a compression ratio of 8.5:1. A three-quarter view of the engine and transmission used in these cars is shown in Fig. 6-178 and 6-179.

Design Features

The cast iron cylinder block is designed with two 90° cylinder banks having four cylinder bores in each bank.

Cylinder numbering is by cylinder arrangement. The right front cylinder is number one, and the left front is number two. Cylinders on the right bank have odd numbers (1, 3, 5, and 7) and those on the left bank have even numbers (2, 4, 6, and 8).

The firing order is 1-5-6-3-4-2-7-8.

The crankshaft is designed to provide a 4.304 inch stroke. The cast nodular iron crankshaft has two and one-half inch diameter connecting rod journals and incorporates five three and one-quarter inch diameter main bearing journals with shell-type inserts of steel-backed aluminum and steel-backed babbitt construction. End thrust of the crankshaft is taken by the center main bearing. Six counterweights are integral with the crankshaft.

Connecting rods for pistons of opposite cylinders are carried side by side on the same crankpin. Shell type connecting rod bearings are steel-backed with a bearing material overlay.

The cast aluminum pistons use two compression rings and one oil ring. To provide a non-scuffing surface when the engine is new, the pistons are tin-plated.

Piston pins are press-fitted into the connecting rods. Broached grooves in each piston pin bore direct oil from the cylinder wall to the piston pin to provide adequate lubrication.

The camshaft is supported by five steel-backed babbitt bearings. It is driven by the crankshaft through a timing chain at the front of the engine. Both the crankshaft and camshaft sprockets have locating marks to provide correct valve timing when the timing chain is installed. Wide camshaft lobe design assures minimum lobe wear.

A drive gear, cast as an integral part of the camshaft, meshes with the driven gear on the distributor drive shaft, Fig. 6-180. The distributor drive shaft rotates in a clockwise direction when viewed from above. This shaft also drives the oil pump.

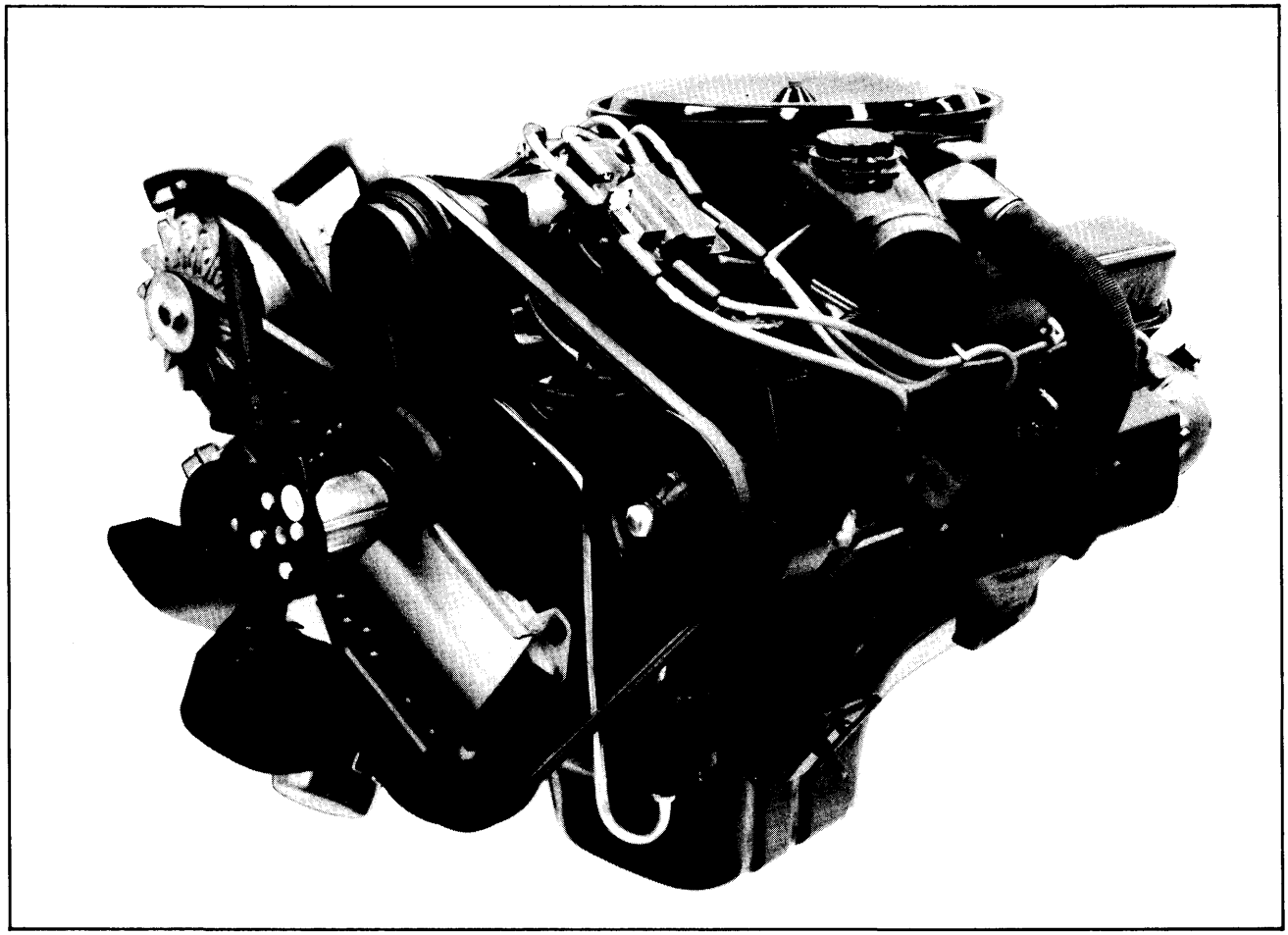


Fig. 6-178 500 Cubic Inch Cadillac Engine Except Eldorado

BACK TO INDEX

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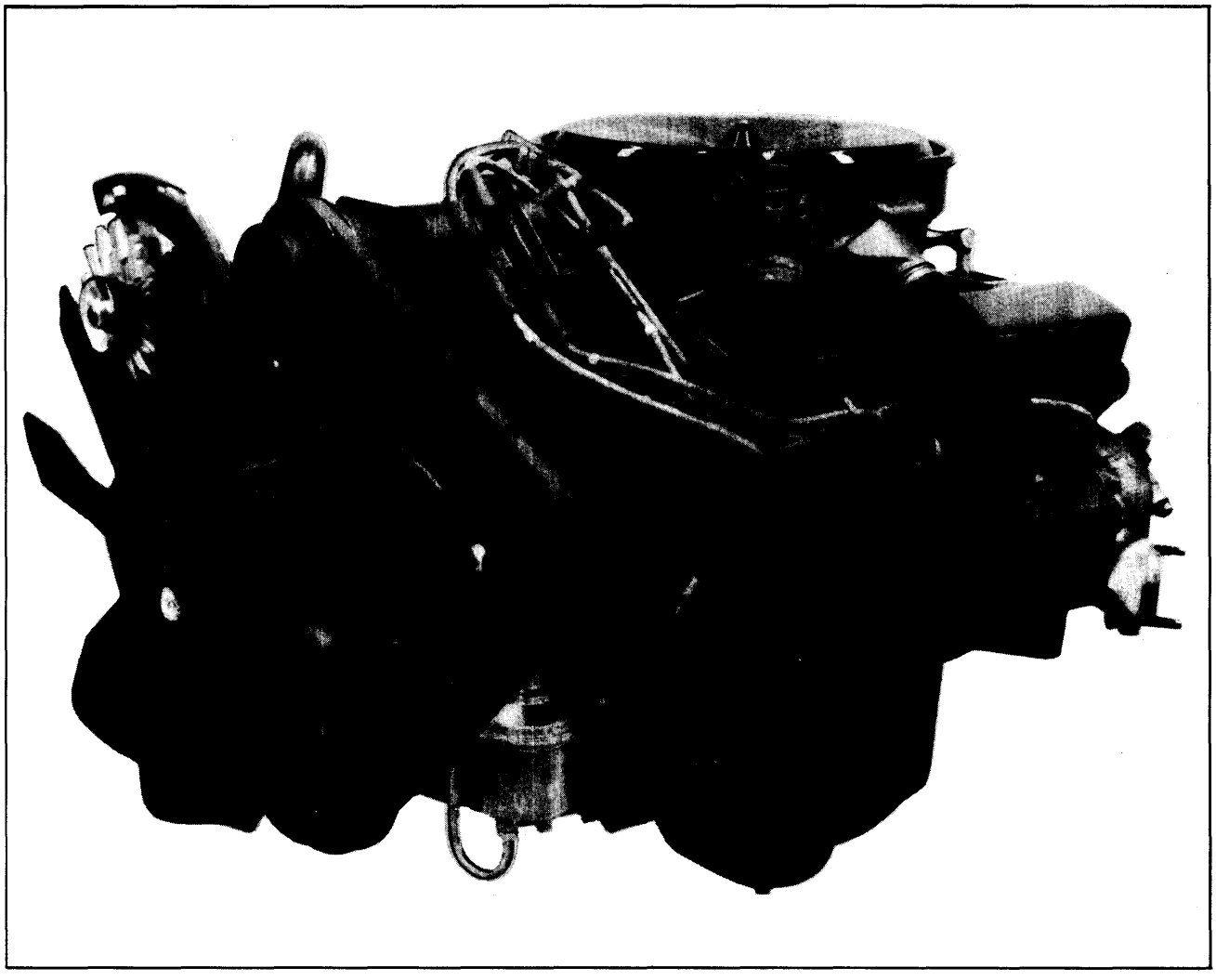


Fig. 6-179 500 Cubic Inch Eldorado Engine

Hydraulic valve lifters are used to maintain zero operating clearance throughout the valve train. This arrangement assures quiet operation and eliminates the need for valve tappet adjustments. The lifters operate in guide holes bored in the cylinder block. The valve lifter plunger and lifter body are selectively fitted in matched pairs. The push rods ride in cups in the lifters and extend up through openings in the cylinder heads to the rocker arms. The valve operating mechanism is illustrated in Figs. 6-181 and 6-186.

A full flow type oil filter is attached to the oil pump housing. The filter assembly incorporates a throw away type filter element and a spring loaded by-pass valve integral with the pump assembly, to assure that the engine oil supply is not interrupted if the element should become clogged.

Oil capacity of the engine crankcase on all series cars except the Eldorado is four quarts; five quarts should be added if the filter is changed.

Oil capacity of the Eldorado crankcase is five quarts; six quarts should be added if the filter is changed.

Three engine support mounts are used; two in the front located on each side of the engine block, and one at the rear of the transmission, Fig. 6-183 and Fig. 6-184. The front mounts are of a completely encapsulated design in that the rubber cushions in the mounts are always under compression.

On all cars except the Eldorado, the front mounts are seated on the main front cross member of the frame and secured by a nut and washer, Fig. 6-183. On the Eldorado, special mounting brackets welded to the frame provide the front attaching points and a special frame cross member is used to provide the seat for the rear mount, Fig. 6-183.

Engine Lubricating System

The oil pump is mounted on the right side near the front of the engine, Fig. 6-182. Oil enters the pump through a screened intake pick-up pipe, and is pumped through the oil filter, through an angular passage in the cylinder block into the right longitudinal header, Fig. 6-182, and crosses over to the left longitudinal header through intersecting vertical passages above the No. 2 camshaft bearing.

The oil continues up the left longitudinal header to the oil pressure signal switch. A dual contact oil pressure

BACK TO INDEX

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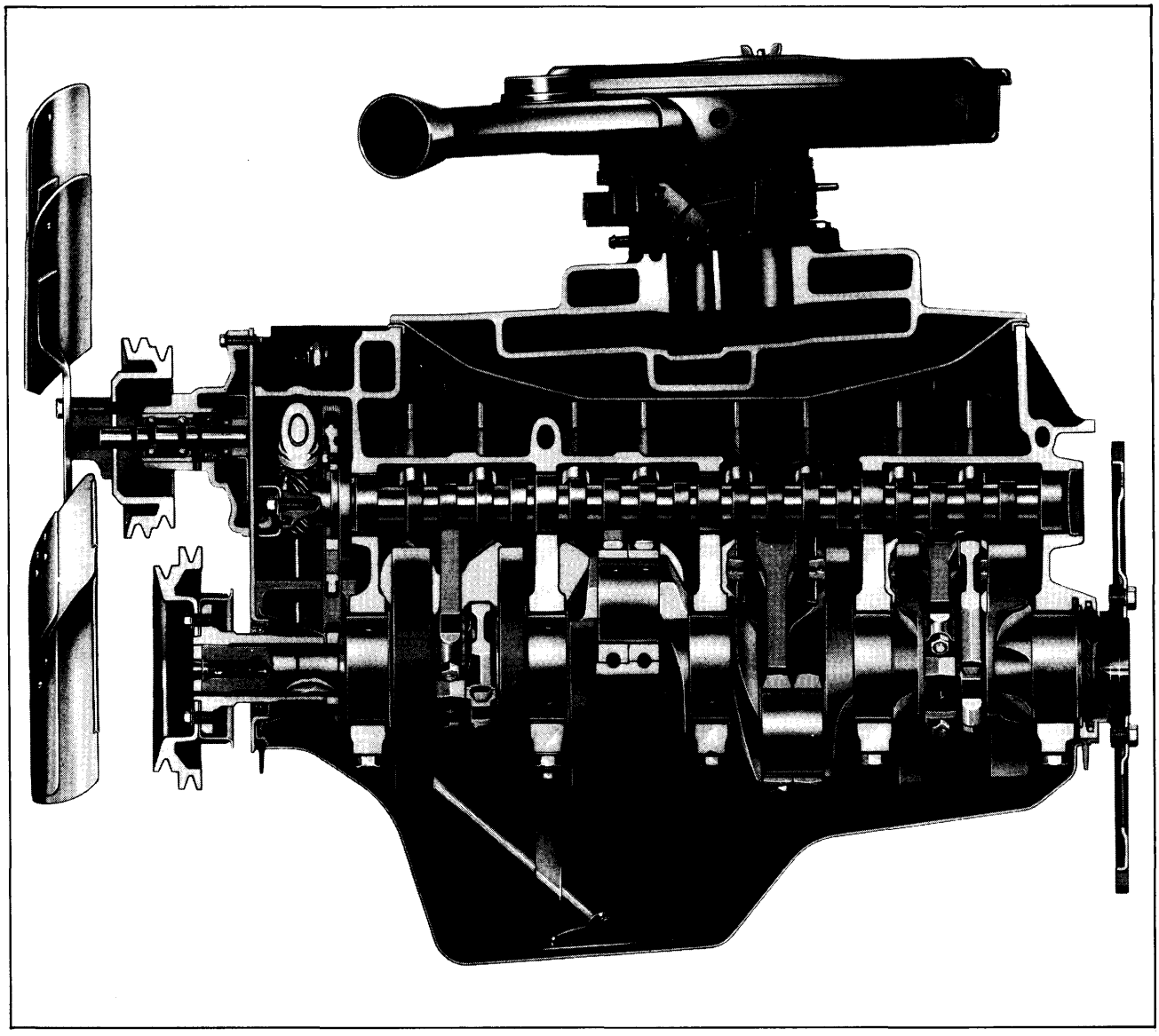


Fig. 6-180 Engine Longitudinal Section

switch is used on all carbureted engines to provide a feed circuit for the carburetor electric choke as well as its function of indicating engine oil pressure. Operation of the electric choke is discussed on page 6-61.

Main bearings No. 2, 3, and 4 are lubricated by oil from the right longitudinal header through holes drilled in the block. Main bearings No. 1 and 5 are lubricated in the same manner by oil from the left longitudinal header. The camshaft bearings are lubricated by oil from the corresponding main bearings through holes drilled in the block. Oil from each main bearing also lubricates adjacent connecting rod bearings through holes drilled in the crankshaft, Fig. 6-182.

The longitudinal headers feed the hydraulic valve lifters through drilled passages, Fig. 6-182. The oil then flows under pressure into the lifters and up through the hollow push rods to the rocker arms. The amount of oil is controlled by a small metering disc in the valve lifter.

The oil comes through a small feed hole in the rocker arm and flows onto the arm, lubricating the rocker arm pivot points as well as the push rod tip and the valve tip.

Oil drains from the cylinder heads into the valve lifter compartment and returns to the oil pan through a hole on the bottom of the compartment.

109. Engine Removal and Installation—Except Eldorado

a. Removal

1. Disconnect negative battery cable.
2. Raise rear of car approximately two feet, place drain pan under radiator, and open petcock to drain radiator.
3. Remove self-tapping screw and washer securing each wheelhousing strut to radiator cover and position struts out of way.
4. Remove six screws and washers securing radiator

BACK TO INDEX

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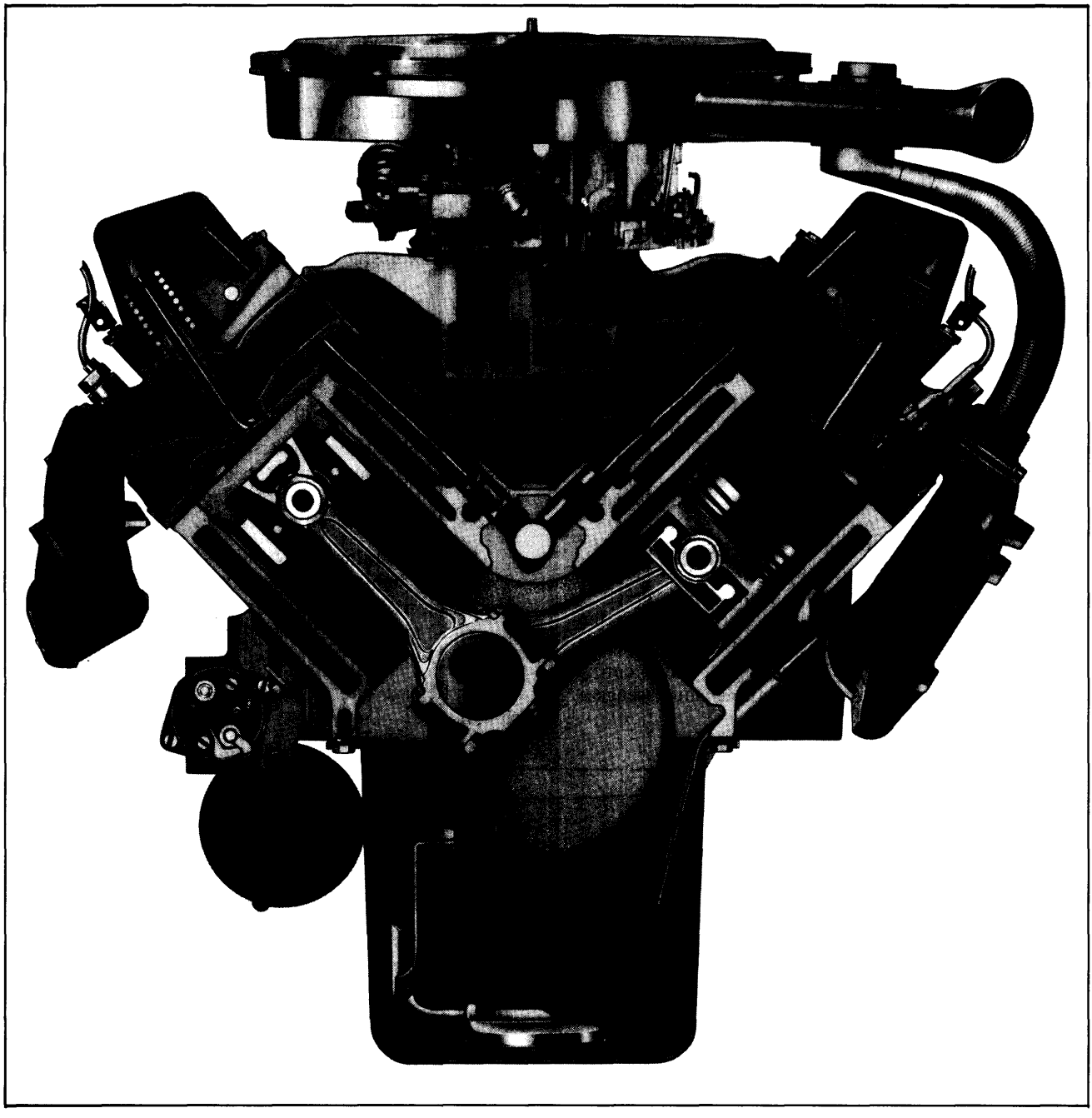


Fig. 6-181 Engine Transverse Section

cover to cradle and one screw securing upper radiator hose to cover and remove cover.

5. Remove hood as described in Section 11, Note 2.
6. Remove air cleaner and inlet duct assembly.
7. Disconnect upper radiator hose from thermostat housing.
8. Disconnect wires at the following locations: coolant temperature sender connector (green wire), HEI connector, downshift switch, engine metal temperature switch, oil pressure switch, heater turn-on switch and A/C compressor.

(NOTE: On car equipped with Electronic Fuel Injection disconnect EFI manifold harness and position out of way.)

9. Disconnect wiring harness from support clip and position harness out of way.
10. Disconnect Cruise Control servo from rear of L.H. cylinder head and disconnect brake hose from brake pipe (to left of Cruise Control servo).
11. Disconnect throttle linkage and Cruise Control bead chain at carburetor and position servo assembly out of way.
12. Disconnect vapor canister hose.
13. Disconnect power steering pump as described in Section 9, Note 7a, Steps 2 through 5 and position pump out of way without disconnecting lines or hoses.
14. Remove fan as described in Note 7a or 8a.
15. Reposition drain pan and disconnect lower radiator hose.

BACK TO INDEX

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16. Remove right side spark plug wires and position out of way.
17. Remove A/C compressor and position out of way on right fender with A/C lines intact, as described in Section 1, Note 17a.
18. Disconnect generator wiring and bend back clips securing wiring harness to right rocker arm cover. Position harness out of way.
19. Disconnect ALC vacuum line on cars so equipped.
20. Disconnect modulator line from back of carburetor.
21. Remove hot water valve hose from fitting in rear of right cylinder head.
22. Remove two nuts securing each cowl-to-wheelhousing tie strut to wheelhousing. Loosen nut securing each strut to cowl and swing struts outboard.
23. Remove top two screws securing transmission to engine.
24. Raise car on hoist.
25. Remove nut and washer securing each engine mount to frame.
26. Remove starter motor as described in Note 25a.
27. Remove four screws securing flywheel inspection cover to transmission and remove inspection cover.
28. Remove screws securing flywheel to converter.
29. Brace exhaust system so that it is supported independently of hangers. Remove two nuts securing exhaust pipe to each exhaust manifold and disengage exhaust system.
30. Disconnect and plug fuel line and vapor return line at fuel pump.
31. Lower car.
32. Move right side lifting bracket to a position such that it straddles the intake passage for #1 cylinder. On E.F.I. engines install bracket J-25511.
33. Place lifting chain in lifting brackets and connect chainfall to lifting chain.
34. Raise engine slowly and pull forward to disengage transmission.
35. Raise engine and remove from car.

b. Installation

1. Raise transmission as high as possible.

(NOTE: It may be necessary to support transmission with a separate jack).

2. Lower engine in chassis on an angle that matches position of transmission. Install two top bolts securing engine to transmission. Right screw also secures transmission dipstick and modulator line.

(NOTE: During this operation use care not to damage any items in the engine compartment (e.g. transmission dipstick tube, throttle linkage, etc.) Some twisting and maneuvering of the engine is sometimes required).

3. Release the floor jack's support of the transmission, if used.

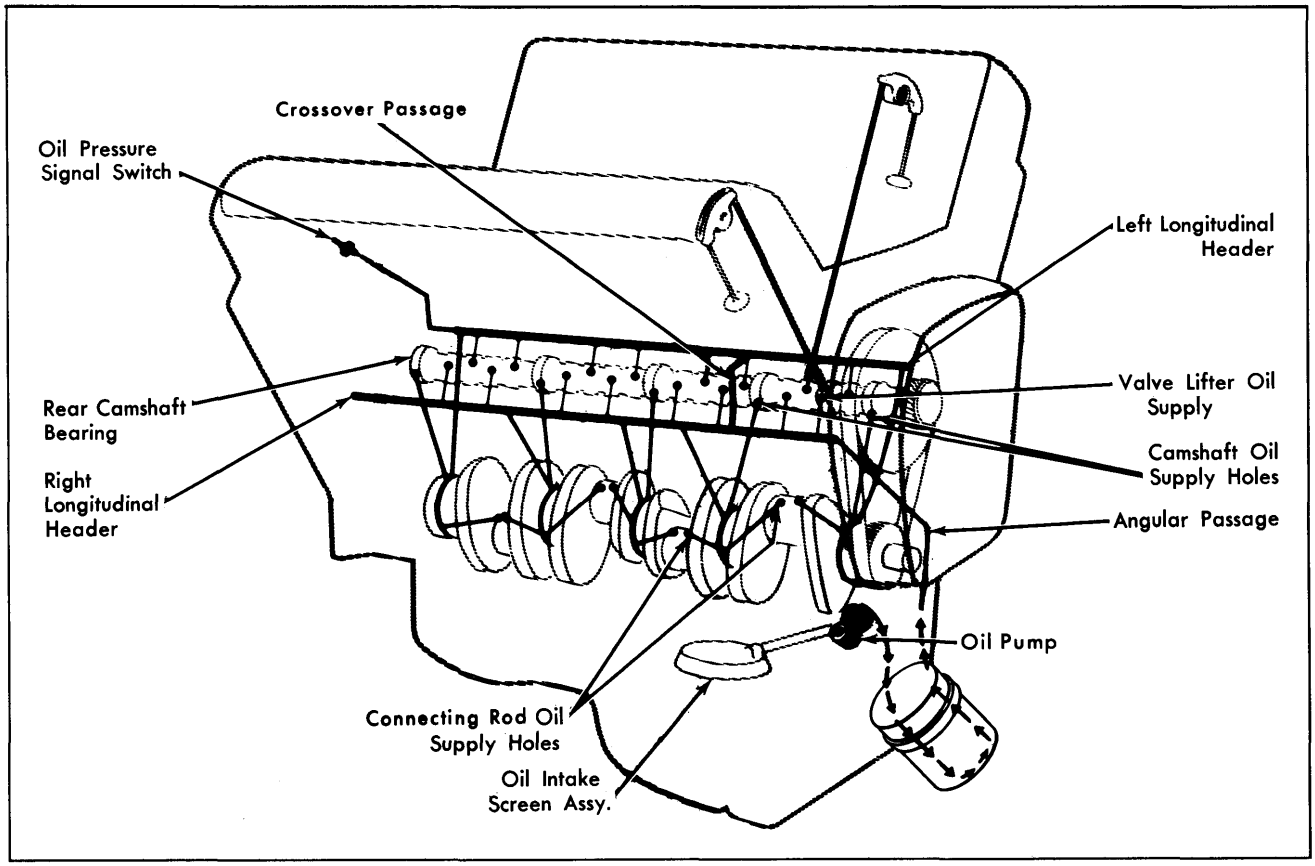


Fig. 6-182 Engine Lubricating Ssytem

BACK TO INDEX

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4. Lower the engine completely, seating the left hand mount first and then the right.
5. Remove lifting equipment.
6. Raise car on hoist.
7. Install four remaining screws securing engine to transmission. Torque screws to 35 foot-pounds.

(NOTE: Make sure harness retaining clip is secured under upper screw on right side).

8. Install three screws securing flywheel to converter. Torque screws to 30 foot-pounds.
9. Position flywheel inspection cover to transmission and secure with four screws.
10. Install starter motor as described in Note 25b.
11. Raise exhaust pipes into position and secure to manifolds with two nuts.
12. Install nuts with washers to engine mount studs. Torque nuts to 52 foot-pounds.
13. Install lower radiator hose to water pump.
14. Install fuel and vapor return hoses to fuel pump.
15. Lower car.
16. Install power steering pump as described in Section 9, Note 7b.
17. Install air conditioning compressor, securing with four screws and connect electrical lead.

CAUTION: Make sure vapor canister hose and distributor vacuum hose are not under compressor or these hoses could be pinched off which could cause poor engine and emission control performance.

18. Install power steering and air conditioning drive belt as described in Note 10.
19. Install upper radiator hose at thermostat housing.
20. Install fan as described in Note 7b or 8b.
21. Route wiring harnesses along both rocker arm covers and secure with metal tabs.
22. Connect wiring at HEI, coolant temperature sender connector, downshift switch, engine temperature switch, generator, heater turn on switch, and oil pressure switch.

(NOTE: On cars equipped with Electronic Fuel Injection, position EFI manifold harness and connect at proper locations.)

23. Connect vapor canister hose.
24. Install throttle cable at linkage.
25. Install Cruise Control servo unit on rear of cylinder head.
26. Install Cruise Control bead chain securing with small clip.
27. Install brake hose on brake line to left of Cruise Control servo.
28. Reposition cowl-to-wheelhousing struts and tighten all fasteners.
29. Install radiator cover, securing with six screws and secure upper radiator hose brace to radiator cover with one screw.
30. Install both wheelhousing-to-radiator cover struts and tighten all fasteners.
31. Install right side spark plug wires and clips.
32. Connect ALC hose at tee fitting if so equipped.
33. Connect hot water valve hose at rear of right cylinder head.
34. Install air cleaner and connect heat ducts and inlet air duct.
35. Close drain cock, fill radiator, and install cap.
36. Connect negative battery cable.
37. Test engine for proper operation. Turn on air conditioning and check for proper operation. Turn steering wheel from stop to stop to check power steering for proper operation.
38. Shut off engine. Check engine oil level. Install hood as described in Section 11, Note 2b.

110. Engine Removal and Installation—Eldorado Only

a. Removal

1. Remove hood.

(NOTE: This operation may be performed by either one or two men. The operation is simplified by constructing four hood hinge-to-retainer bolts with the heads cut off. Use two at each side and install them in the hood hinge bolt holes as the regular bolts are removed. This will serve to locate the hood during removal and installation.

The one-man operation involves supporting the front of the hood with a fan belt wrapped through the hood bracing and hooked to a chainfall).

2. Open radiator petcock and raise rear of car to facilitate draining.
3. Remove carburetor air cleaner, inlet duct, vacuum hoses and hot air ducts.
4. Remove upper radiator hose at thermostat housing and remove bracket at cradle.
5. Remove radiator cover - six screws.
6. Remove fan blade assembly as described in Note 7a or 8a.
7. Disconnect negative battery cable, generator wires, right hand spark plug wires, and heater turn-on switch and position harness out of way. Route spark plug wires away from top of compressor.
8. Disconnect water control valve hose at rear of block. Disconnect starter motor wiring harness at multiple connector.
9. Remove power steering pump (do not disconnect hoses) and position out of way. Remove all drive belts. (Lower power steering pump bolt is most easily removed with 9/16" flex socket, about 9" of extension, and small 3/8" drive ratchet. Position pump with hoses attached near evaporator canister).
10. Remove A/C compressor mounts (four screws, one nut), disconnect electrical lead and move compressor to top of battery.
11. Disconnect throttle and Cruise Control linkage at throttle body or carburetor and bracket. Position cables out of way.
12. Disconnect wires on left branch of engine harness (compressor, downshift switch, etc.) and position out of way.

BACK TO INDEX
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(NOTE: On cars equipped with Electronic Fuel Injection disconnect manifold harness and position out of way.)

13. Disconnect vacuum lines at rear of carburetor and position out of way.
14. Remove left exhaust manifold flange nuts.
15. Remove transmission cooler line bracket screw and filler pipe nut from exhaust manifold.
16. Change right hand engine lift hook to position over No. 1 intake port. On E.F.I. cars install bracket J-25511.
17. Remove upper screw securing steering gear flex coupling shroud to frame.
18. Raise car on hoist.

(NOTE: A twin post hoist is preferred for this operation.)

19. Remove remaining screw securing steering gear flex coupling shroud to frame and remove shroud.
20. Remove bolt and nut securing final drive bracket to motor mount.
21. Disconnect fuel pump lines and plug.
22. Remove nut and washer securing each front engine mount to frame.
23. Remove lower radiator hose.

(NOTE: Drain hose and position out of way on bottom of car. Hose clamp is likely to be crushed during installation if not repositioned.)

24. Remove right exhaust manifold flange nuts.
25. Remove starter motor. Do not disconnect wiring from terminals.
26. Remove flywheel inspection cover.

(NOTE: It is possible to perform Step 27 without removing this cover, however, removal of the three accessible bolts is necessary so the cover may be moved to reach converter screws. One cover screw is very difficult to reach.)

27. Remove flywheel-to-converter screws.

(NOTE: Use a 1962 Harmonic Balancer screw - #147 0868 and washer - #147 0867 to turn crankshaft.)

28. Remove two lower transmission-to-block screws.
29. Remove right hand output shaft screws.

(NOTE: This is easily done by one man if a long breaker bar is used. Hold tire with one hand and loosen screw with bar. When all screws are loose, use a small 3/8" drive ratchet with about 18" of extension.)

30. Remove two output shaft bracket to block screws and one screw securing bracket to final drive.
31. Loosen right hand shock absorber lower mounting nut and move shock outward on stud.
32. Move drive axle as far back as possible and remove output shaft.
33. Lower car.
34. Remove four screws securing transmission to block, two at top and two at left hand side of engine.
35. Install lifting chain and chain fall.
36. Place floor jack with a soft (wood) face under transmission pan for support.
37. Remove engine.

b. Installation

1. Install engine.

(NOTE: Use of longer transmission to engine screws will simplify engine locating. Install these bolts in the top two holes. Use of a long screwdriver or pry bar will provide pressure at appropriate points.)

2. Install four transmission to engine screws, two at top and two at left hand side of engine.
3. Remove chain fall, jack and blocks.
4. Raise car.
5. Install two remaining screws securing transmission to engine.
6. Install screws securing converter to flywheel and remove harmonic balancer screw and washer.
7. Secure inspection cover with three screws.
8. Install starter motor.
9. Install output shaft and tighten lower shock mount nut.
10. Install right hand exhaust pipe flange nuts.
11. Install nuts with washers to engine mount studs. Torque nuts to 52 ft. lbs.
12. Install bolt and nut securing final drive bracket to left engine mount.
13. Install flex coupling shroud and secure with lower screw.
14. Connect fuel lines.
15. Install lower radiator hose.
16. Lower car.
17. Install fan blade assembly and belts as described in Note 7b or 8b.
18. Install transmission cooler line bracket and dipstick tube bracket.
19. Install throttle and Cruise Control linkage.
20. Install left hand exhaust pipe flange nuts.
21. Install remaining screw securing flex coupling shroud to frame.
22. Install power steering pump.

(NOTE: Lower power steering pump bolt is most easily installed with a 9/16" flexible socket, about 9" of extension, and small 3/8" drive ratchet.)

23. Install A/C compressor.
24. Connect heater hose to right cylinder head.
25. Connect remaining wires and vacuum hoses.

(NOTE: Position and connect Electronic Fuel Injection manifold harness on E.F.I. cars).

26. Install upper radiator hose.
27. Install radiator cover.
28. Refill coolant.
29. Tension generator and power steering belts.
30. Install battery cable.
31. Install air cleaner, inlet duct and connect heat ducts.

BACK TO INDEX

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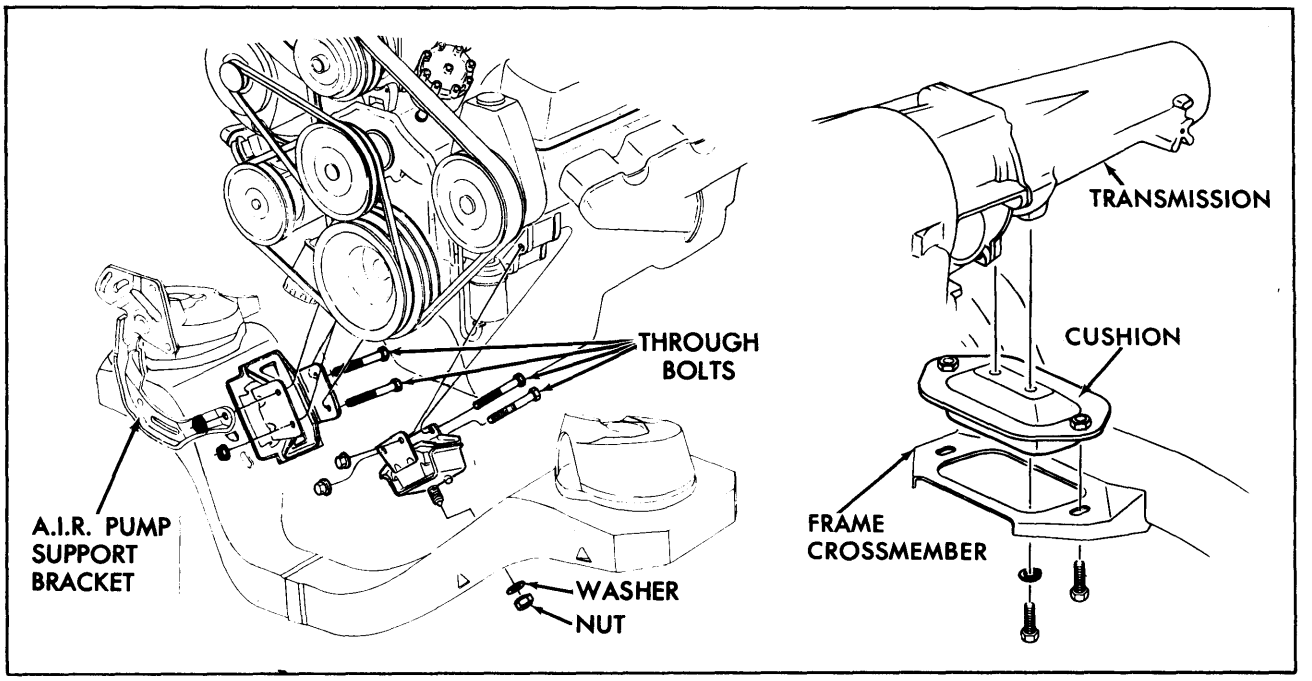


Fig. 6-183 Engine and Transmission Mounts–"C" Car

32. Install hood and align.
33. Start engine and check for leaks.

111. Engine and Transmission Support Mount (Except Eldorado)

a. Front Engine Mount Removal (Fig. 6-183)

1. Open hood and remove radiator cover.
2. Raise car on hoist.
3. Remove two through bolts from mount to be replaced (left or right).
4. If left hand (driver's side) mount is being replaced, remove nut and washer from both mounts.
5. If right hand (passenger side) mount is being replaced, remove nut and washer from left hand mount and loosen right hand nut until no threads are visible on stud.
6. Support car with stands at each front frame horn.
7. Apply pressure (hoist, jack, etc.) to oil pan. Apply pressure over entire bottom of sump with no concentration of pressure due to bumps or knobs on lift.
8. Raise engine until mount may be removed and remove mount by pulling straight back.

b. Front Engine Mount Installation (Fig. 6-183)

1. Position mount in place between cylinder block and frame.
2. Lower engine until through bolts may be installed through mount from back of mount. It may be necessary to first install lower through bolt, then lower engine carefully, allowing mount to pivot, until upper through bolt mounting holes line up.

(NOTE: On right side, upper through bolt must also pass through A.I.R. mounting bracket on cars so equipped.)

3. Continue lowering engine until it is in driving position.
4. Torque through bolt nuts to 21 foot-pounds.
5. Install nut and washer on mount stud and torque nut(s) to 52 foot-pounds.
6. Remove stands and lower car from hoist.
7. Install radiator cover.

c. Transmission Mount Removal

1. Raise car on hoist.
2. Remove two mount to transmission extension housing bolts.
3. Remove two nuts, washers, and bolts securing cross member to frame on each side.

(NOTE: It may be necessary to pry floor pan up for clearance to remove bolts.)

4. Remove parking brake cable from bracket on cross member.
5. Position transmission support under extension housing or oil pan.
6. Remove cross member by raising transmission or lowering vehicle.
7. Remove two nuts and bolts and remove rear mount from position in cross member.

d. Transmission Mount Installation

1. Install rear mount to cross member with weld nuts up and secure with two nuts and bolts.

BACK TO INDEX

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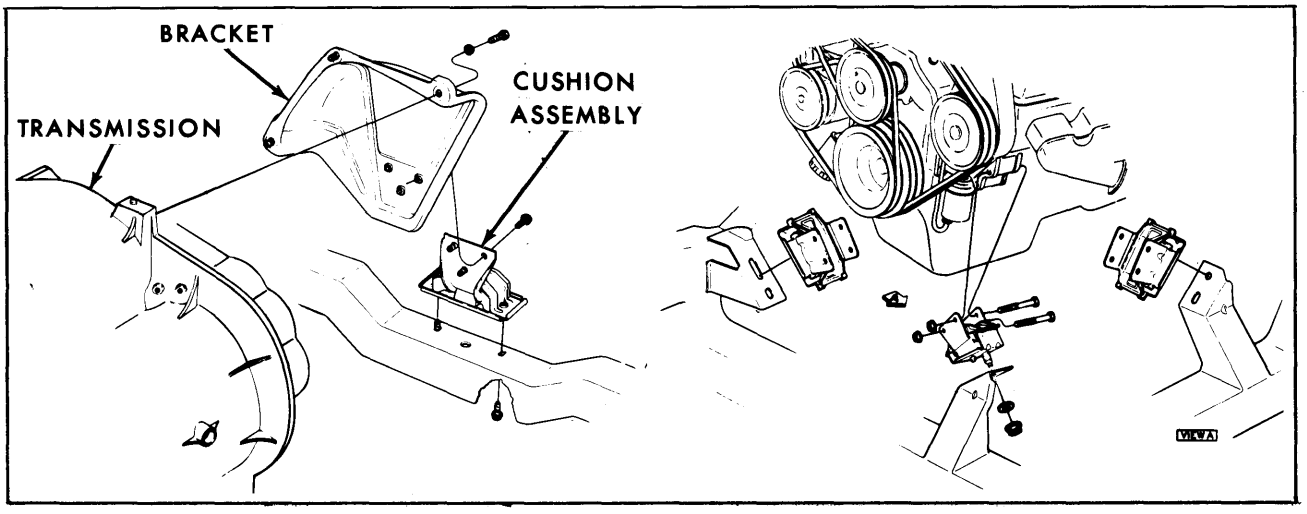


Fig. 6-184 Engine and Transmission Mounts—Eldorado

2. Install cross member and secure with two nuts, washers and bolts at each side.

(NOTE: Bolts should face down with nuts on bottom.)

3. Install two bolts securing mount to transmission extension housing.
4. Install brake cable in bracket at cross member.
5. Remove transmission support.
6. Lower car.

112. Engine and Transmission Mounts—Eldorado Only (Fig. 6-184)

a. Left Front Engine Mount Removal

1. Remove radiator cover and disconnect negative battery cable.
2. Raise car and remove nut and washer from engine mount stud.
3. Remove capscrew securing transmission cooler lines to final drive bracket.
4. Remove screw securing top of steering gear flex coupling shroud to frame.
5. Remove nut from large through bolt securing top of engine mount and top of final drive bracket to engine.
6. Raise car and remove nut from lower engine mount through bolt.

(NOTE: Attach box end wrench to nut, then use pry bar between wrench and engine.)

7. Remove remaining screw securing flex coupling shroud to frame and remove shroud.
8. Remove cross bar bolt, nut, and two washers securing bottom of final drive bracket to final drive. Remove bracket by tipping back and to left of car.
9. Using block of wood and jack stand, lift engine from frame at crankshaft pulley to relieve load on engine mount bolts and remove both bolts from mount.
10. Loosen, but do not remove, nut and washer from right engine mount stud.
11. Raise engine sufficiently to remove mount from car. Work mount down and forward between fuel pump and frame.

(NOTE: If interference from fan is encountered, rotate fan blades to a slightly different position.)

b. Left Front Engine Mount Installation

1. Work mount up between frame and fuel pump, engaging mount stud and locating knob in holes in frame.
2. Install lower through bolt from rear of engine mount. Install nut but do not torque at this time.
3. Position final drive bracket and install upper through bolt from rear of engine mount, making sure through bolt properly secures final drive bracket to mount. Install nut but do not torque at this time.
4. Lower engine to normal ride position, making sure stud and locator knob on each mount enter holes in frame.
5. Install bolt, nut, and two washers securing bottom of final drive bracket to final drive, tightening to 65 foot-pounds.
6. Torque nuts on both through bolts to 20 foot-pounds.
7. Torque nut and washer securing right engine mount to frame to 52 foot-pounds.
8. Install nut and washer securing left engine mount to frame, tightening to 52 foot-pounds.
9. Secure transmission cooler lines to final drive bracket with one screw and clip.
10. Position flex coupling shroud on frame and install lower screw.
11. Lower car.
12. Install upper flex coupling shroud mounting screw.
13. Install radiator cover. Connect negative battery cable, tightening to 70 inch-pounds.

c. Right Front Engine Mount Removal

1. Remove six screws securing radiator cover to

BACK TO INDEX
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radiator cradle and one screw securing upper radiator hose bracket to cover and remove cover.

2. Remove nut and washer securing left engine mount to frame.

3. Raise car.

4. Remove nut and washer securing right engine mount to frame.

5. Reach between right engine mount and oil pump to attach open end wrench to nut on lower bolt securing engine mount to engine block. Holding this wrench in place, remove lower mounting bolt from rear, using ratchet, U-joint socket, and about 18" of extension.

6. Work end wrench up between oil pump and crankshaft pulley and position wrench in a straight vertical position to engage nut on upper mounting bolt. Holding wrench in place, use same tools as in Step 5 to remove upper mounting bolt.

(NOTE: If nut is impossible to engage, an alternative is to first perform Step 7, then use a 5" extension and a 9/16" crowfoot adapter and engage tool on nut by slipping between oil pump and A.I.R. pump.)

7. Place jackstand under crankshaft pulley and, using wood block to avoid damage to pulley, either raise engine or lower chassis enough to remove mount.

CAUTION: When separating engine and chassis, observe relative position of frame rail and right drive axle tri-pot housing. Interference between these parts requires removal of right drive axle before mount can be removed. Furthermore, if tri-pot housing does clear the frame, vertical movement is limited by presence of fuel lines. Do not allow tri-pot housing to contact fuel lines.

8. Work mount free and pull rearward over tri-pot housing to remove from car.

d. Right Front Engine Mount Installation

1. Position mount between engine and frame.

2. Install upper mounting bolt and nut securing engine mount to engine.

3. Install lower mounting bolt and nut securing mount to engine.

4. Torque upper and lower mounting bolts and nuts to 20 foot-pounds.

5. Lower engine into chassis, making sure each mount stud and locater engages its mounting hole in frame.

6. Install nut and washer securing right mount to frame, tightening to 52 foot-pounds.

7. Lower car.

8. Install nut and washer securing left mount to frame, tightening to 52 foot-pounds.

9. Secure radiator cover with six screws and install upper radiator hose and bracket on radiator cover.

e. Transmission Mount Removal (Fig. 6-184)

1. Raise car on hoist.

2. Remove two screws securing transmission mount to frame cross bar, Fig. 6-184.

3. Place jack stand under transmission pan. Use a block of wood to protect pan.

4. Lower chassis slightly to relieve vertical load on mount.

5. Remove three screws securing mount to transmission bracket and remove mount.

f. Transmission Mount Installation

1. Position mount against rear of transmission bracket and secure with three screws, tightening to 25 foot-pounds.

(NOTE: While performing this step observe alignment of holes in mount and holes in frame to make sure installation of screws will be possible.)

2. Raise chassis so that transmission is in normal ride position and transmission mount assumes normal load.

3. Install two screws securing transmission mount to frame cross bar, tightening to 25 foot-pounds.

4. Remove jack stand and wood block from under transmission pan and lower car.

113. Intake Manifold

a. Removal

1. Disconnect negative battery cable.

2. Remove air cleaner, disconnecting the thermal vacuum hose, heat tube, and crankcase ventilating breather.

3. Disconnect carburetor and Cruise Control linkage at throttle adapter plate.

4. Disconnect HEI connector.

5. Disconnect R.H. spark plug wires at spark plugs and position out of way.

6. Disconnect black wire from A/C compressor superheat switch.

7. Disconnect two orange wires from downshift switch.

8. Remove throttle return spring and downshift switch bracket.

9. Disconnect power brake vacuum line and vacuum modulator line from rear of carburetor. Remove top mounting bolt from Cruise Control servo and position brake line out of way.

10. Disconnect double connector from compressor clutch.

11. Disconnect air conditioning system vacuum and TVS vacuum hoses from rear of manifold.

12. Disconnect fuel line at carburetor and move slightly out of way.

13. Disconnect distributor vacuum advance and canister purge hoses at carburetor and position out of way.

14. Partially remove compressor as described in Section 1, Note 17a.

15. Disconnect PCV valve from right rocker arm cover and Automatic Level Control vacuum hose.

16. Remove ten screws and two screw/studs securing manifold to cylinder heads and remove manifold.

BACK TO INDEX

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17. Remove sheet metal manifold shield and gasket.
18. Remove rubber front and rear manifold to cylinder block gasket.

b. Installation

1. Coat ends of rubber seals with gasket cement and place over rails at front and rear of cylinder block. Tabs on seals should be positioned in holes in rails and beveled ends of gasket tucked under edge of cylinder head.
2. Coat upper and lower surfaces of port area of sheet metal gasket (do not coat ends). Place on engine and engage over dowel pins on cylinder heads.
3. Carefully position manifold on cylinder heads by lowering straight down. Secure manifold with ten screws and two screw/studs. Tighten to 30 foot-pounds.
4. Connect P.C.V. valve to right rocker arm cover, and Automatic Level Control vacuum hose.
5. Install compressor as described in Section 1, Note 17b.
6. Connect distributor vacuum advance and canister purge hoses to carburetor.
7. Install ignition wires on spark plugs and clips.
8. Install fuel line at carburetor.
9. Connect power brake vacuum line to fitting on rear of carburetor. Secure brake line clip under top Cruise Control servo mounting screw.
10. Connect vacuum modulator line to fitting at rear of carburetor.
11. Connect double connector to compressor clutch.
12. Connect single connector green wire to temperature sender.
13. Connect HEI connector.
14. Install orange/black and orange/white wires to downshift switch.
15. Connect Cruise Control and throttle linkage at throttle adapter plate.
16. Install air cleaner bottom making sure heat tube engages heat shield on exhaust manifold and thermac vacuum hose is connected.
17. Carefully install crankcase ventilating breather. Install and tighten air cleaner cover.
18. Install Automatic Level Control, hose to air cleaner.
19. Check routing of all hoses around carburetor to make sure they do not interfere with the proper operation of the throttle linkage.
20. Connect negative battery cable.
21. Start engine and inspect for leaks.

114. Exhaust Manifold—Right or Left

a. Removal

1. If working on left manifold, remove carburetor air cleaner and heat duct. Remove nuts from #2 and #8 cylinder (#2 and #6 on Eldorado only) manifold studs and remove air cleaner support rod and heat shroud from around manifold.
2. Remove two nuts securing header pipe to exhaust manifold at side being worked on. If working on right side remove two studs holding EFE valve to right hand manifold and remove EFE valve.
3. Remove eight screws securing exhaust manifold to cylinder head. If working on left manifold on an Eldorado, also remove clip securing dipstick tube.

(NOTE: Fifth screw from front may not be removable due to frame interference. If so, back screw off all the way and remove with manifold in Step 4.)

4. Remove exhaust manifold from position in engine compartment.

b. Installation

1. Lubricate cylinder head mounting surfaces of the exhaust manifold with a thin coat of a moly-based lubricant (graphite).
2. Insert fifth screw from front in manifold and position manifold in location on cylinder head.
3. Install remaining screws. If working on left manifold, install screw/stud in front attaching hole of #2 cylinder and rear attaching hole of #8 cylinder (front hole of #2 and #6 on Eldorado only). Torque all screws to 35 foot-pounds.

(NOTE: If working on Eldorado left manifold secure dipstick tube retaining clip under one screw.)

4. If working on left manifold, position heat shroud and air cleaner support rod to exhaust manifold and secure with two nuts. If working on right side position EFE valve to right hand exhaust manifold with actuator towards engine block. Secure with two stud-bolts, tighten to 35 ft. lbs.
5. Move exhaust pipe into position at manifold and secure with two nuts.
6. If working on left manifold, install carburetor air cleaner making sure heat duct engages heat shroud on manifold.

115. Rocker Arm Covers

a. Removal

1. If working on left side, remove air cleaner, heat duct, and crankcase ventilating breather.
2. If working on right side, remove PCV valve and elbow from cover. Remove generator wiring harness from clips.
3. Remove spark plug cable clips from studs, Fig. 6-185, and position out of way.
4. Remove screws holding cover to head and remove cover.

(NOTE: If cover removal is difficult, use hammer and block of wood to loosen. Do not pry on rocker arm cover.)

b. Installation

1. Using a new gasket, position cover on cylinder head and secure with nine screws. Screw/studs should be installed in locations shown in Fig. 6-185. Tighten screws to 30 inch-pounds.
2. Position spark plug cable clips on studs, Fig. 6-185.

BACK TO INDEX
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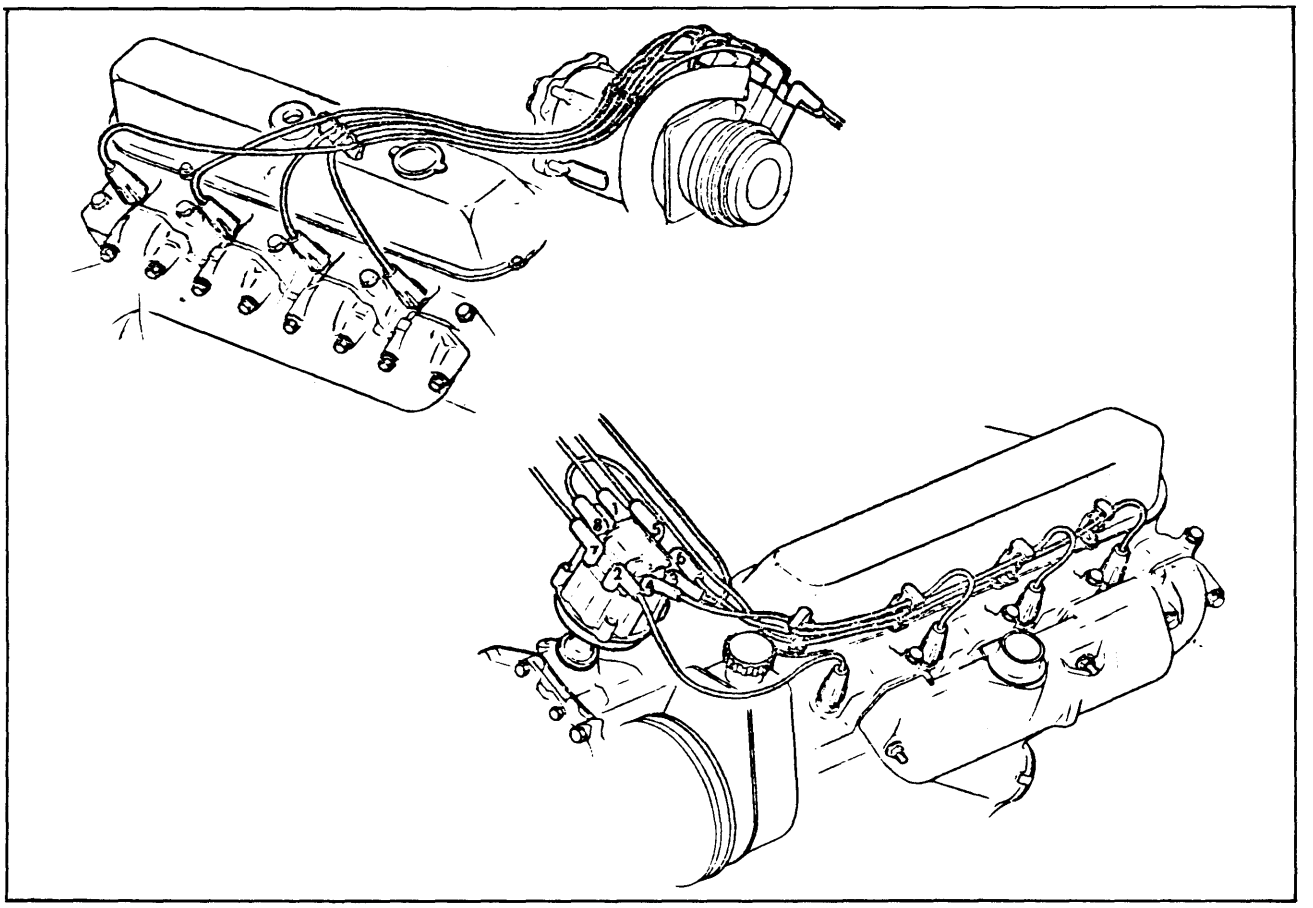


Fig. 6-185 Spark Plug Wire Routing

3. If working on right side, install PCV valve and elbow. Reposition generator wiring harness under clips.
4. If working on left side, install crankcase ventilating breather and air cleaner, making sure heat duct engages heat shroud on exhaust manifold.

116. Valve Train Diagnosis

Poor engine performance or noisy engine operation may be caused by worn or damaged parts in the valve train. If valve problems are indicated such as by a compression test, camshaft speed engine noise, excessive oil consumption, etc, remove rocker arm covers and inspect the following valve train components.

1. Valve spring
2. Valve spring retainer and oil shedder.
3. Rocker arm, retainer and support.
4. Pushrod
5. Valve stem
6. Valve guide

Noisy operation of valve lifters may be due to:

a. Incorrect Engine Oil Level

Oil level should never be above, nor more than a quart below "Full" mark on indicator. If level is too high, foaming may result, if too low, air may enter pump inlet. In either case, noisy valve action may result.

b. Improper Oil Pressure

If valve action is noisy after the oil is hot, it may be due to low oil pressure.

Low pressure usually results from an external leak in the engine lubrication system, a stuck or improperly operating oil pressure relief valve, scored parts, worn bearings, worn oil pump gears, clogged oil intake strainer screen assembly, or poor operation of oil pump.

c. Rusty or Varnished Valve Stems or Valve Guides

This condition may be associated with short trip operation, poor quality engine oil, or failure to change oil regularly.

d. Weak Valve Lifter Springs

These can cause noisy valve operation by causing sluggish plunger movements in the cylinder. To check these springs, disassemble plunger assembly, clean thoroughly and reassemble. Check pressure to compress spring with lifter dry.

If pressure required to compress spring 11/32 inch is less than 6-1/4 pounds, the assembly should be replaced.

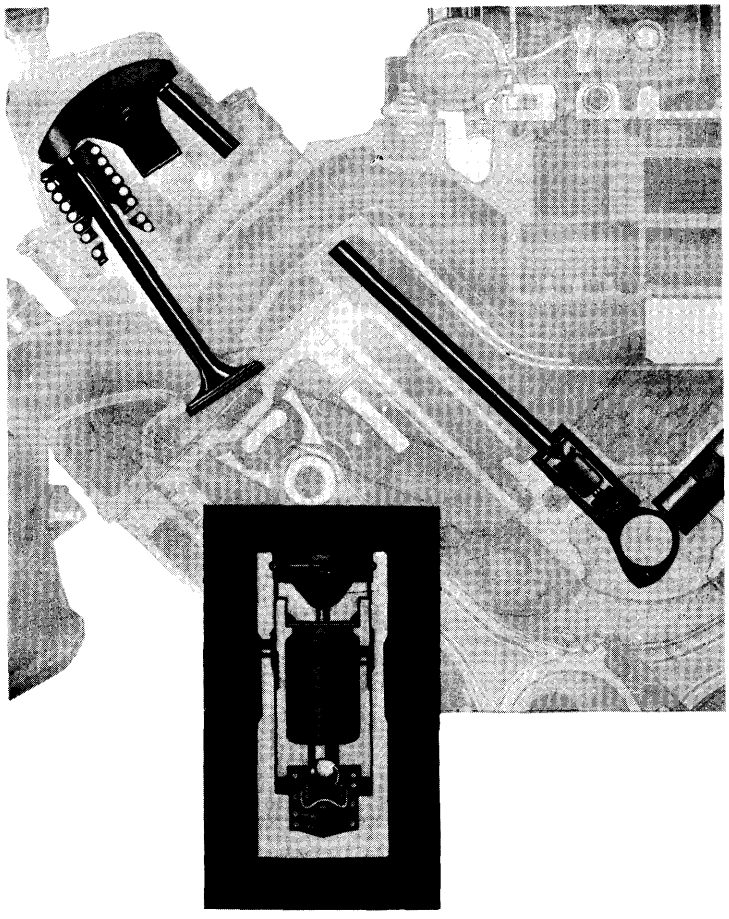
e. Dirty, Worn, or Scored Valve Lifter Parts

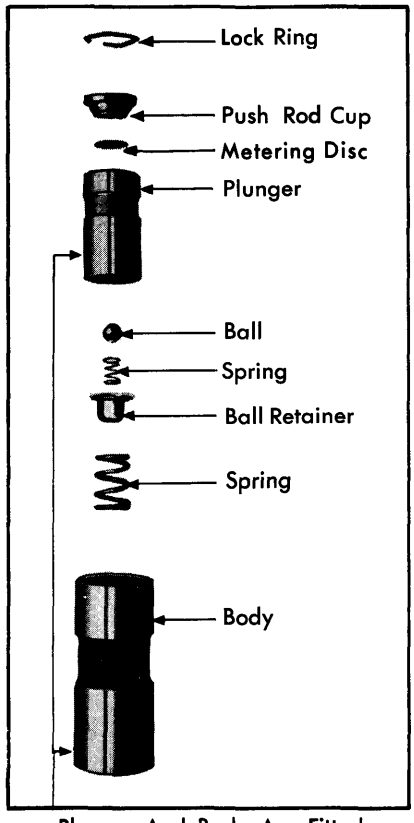
A recurring tap or click synchronized with valve action, indicates trouble in a single lifter assembly, which should be disassembled and checked for:

BACK TO INDEX

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ARRANGEMENT OF VALVES AND VALVE LIFTERS





Plunger And Body Are Fitted Pairs And Must Not Be Mismated.

OPERATION OF VALVE LIFTER MECHANISM

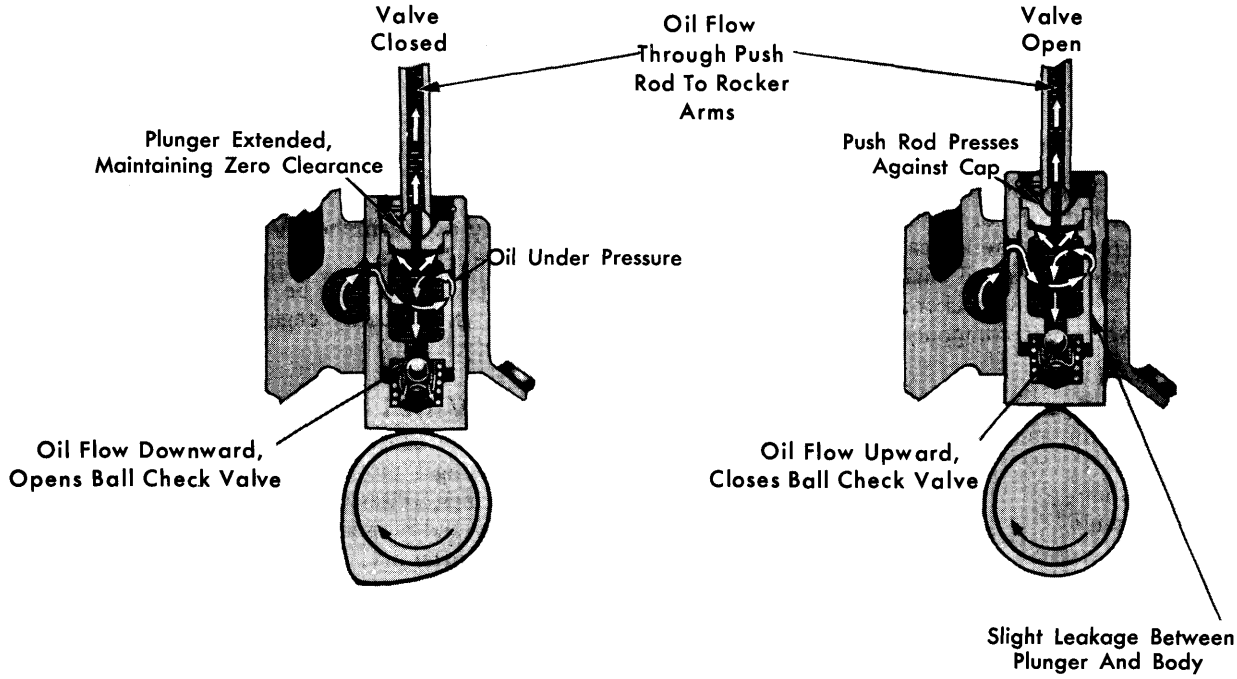


Fig. 6-186 Valve Lifter Mechanism

BACK TO INDEX

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1. Dirt or foreign particles, which can be removed after disassembly by wiping with a soft cloth and washing in kerosene.
2. Varnish or heavy sludge material, which can be removed with solvent.

(NOTE: The engine oil pan should always be removed and cleaned when dirt has been responsible for sticking lifters. The oil passages from the header to the lifter bores should also be cleaned thoroughly by blowing out with kerosene and air.)

3. Pitting and scoring of surfaces, which may result from gritty particles, excessive wear, poor grade oil, or damage during installation. This condition requires replacement of the complete unit.
4. Incorrect clearance between cylinder and plunger, usually caused by mismating of parts. These parts are selectively fitted in manufacturing and are not interchangeable.

f. Lifters That Do Not Turn In Their Bores

Scoring, surface flaking, cupping, or excessive wear on the bottom of the lifter may prevent the lifters from turning in their bores.

g. Other Causes

Excessive wear on either end of rocker arm or at rocker arm support; worn valve stems; worn or bent push rods; worn camshaft lobes; air in suction side of oil pump system.

117. Valve Lifter Leak-Down Rate Checking

The Valve Lifter Leak-Down Rate Tester, J-3074, is used to obtain a comparison of leak-down rates of hydraulic valve lifters without removing them from the engine. With this tool, a feeler gage of a given thickness is placed between the rocker arm and the valve stem, causing valve spring pressure to force oil out of the lifter. A spring, attached to the tool and compressed against the valve spring retainer, ejects the feeler gage when the lifter has leaked down enough to allow the valve to seat. By observing the length of time required by each lifter to leak-down the thickness of the feeler gage, a faulty lifter or lifters can be easily located.

Use the following procedure:

1. Operate engine to allow lifters to fill with oil.

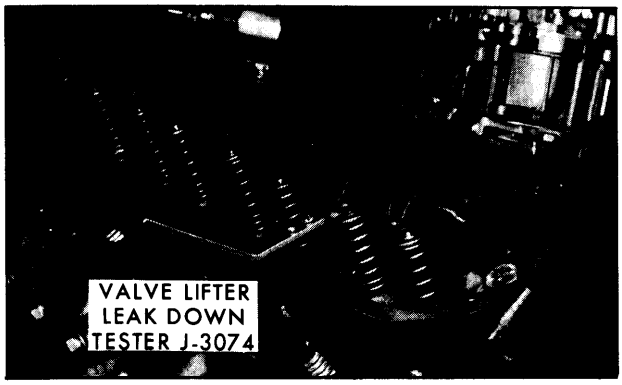


Fig. 6-187 Checking Valve Lifter Leak-Down Rate

2. Turn off engine. Remove distributor cap and rotate crankshaft so that rotor is at No. 1 firing position.
3. Remove carburetor air cleaner.
4. Disconnect negative battery cable.
5. Disconnect spark plug wires at plugs and remove wiring from tabs on rocker arm covers, but leave wiring connected.
6. Remove rocker arm covers as described in Note 115a.
7. Check each lifter listed in following table as shown in Fig. 6-187.

Rotor at No. 1 firing position.
Check:

1	Intake	1	Exhaust
2	Intake	3	Exhaust
5	Intake	5	Exhaust
7	Intake	6	Exhaust
8	Intake	8	Exhaust

8. Insert feeler gage of tool between valve stem and rocker arm and at the same time, compress tool "pop-out" spring to its stock against valve spring retainer, Fig. 6-187.

(NOTE: Install tool as quickly as possible to eliminate any unnecessary lifter leak-down.)

9. Note interval of time during which tool is held in place by valve spring pressure. The noisy lifter or lifters will have the shortest leak-down time.
10. Connect negative battery cable, install distributor cap, connect spark plug wires, and operate engine to allow lifters again to fill up with oil.
11. Turn off engine, remove distributor cap and rotate crankshaft so that rotor is at No. 4 firing position. Disconnect spark plug wires and negative battery cable.
12. Check each lifter listed in the following table:

Rotor at No. 4 firing position.
Check:

3	Intake	2	Exhaust
4	Intake	4	Exhaust
6	Intake	7	Exhaust

13. Install rocker arm covers as described in Note 115b.
14. Install distributor cap.
15. Install carburetor air cleaner.
16. Connect negative battery cable.
17. Operate engine to obtain operating temperature and retorque rocker arm cover screws to 30 inch-pounds.

118. Valve Lifter

a. Removal

1. Remove intake manifold as described in Note 113a.
2. Remove rocker arm covers as described in Note 115a.
3. Remove screws securing rocker arm supports to cylinder heads.
4. Remove rocker arm assemblies. Store rocker arm assemblies so that they can be reinstalled in same location.

BACK TO INDEX
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5. Remove push rods.

6. Using a small screwdriver, or pointed tool, remove lifters from engine. Keep them in order so they can be re-installed in same bores from which they were removed. Use Valve Lifter Remover, J-3049, to remove any lifters that are stuck, rotating lifter back and forth while lifting, Fig. 6-188.

b. Installation

1. Apply a small amount of rear axle lubricant to foot of each lifter.

2. Install valve lifters in same bores from which they were removed.

3. Install push rods through openings in cylinder heads. Bottoms of push rods must be seated in hydraulic valve lifter cups.

4. Install rocker arm assemblies on cylinder heads securing with screws. Tighten screws to 60 foot-pounds.

5. Position new rocker arm cover gaskets on cylinder heads.

6. Install rocker arm covers as described in Note 115b.

7. Install intake manifold as described in Note 113b.

119. Valve Lifter Disassembly and Assembly

a. Disassembly

(NOTE: Valve plungers and bodies are matched in pairs and are not interchangeable with one another. In order to fit properly, they must be reassembled to their original matching pairs.)

1. Press down on center of valve lifter push rod cup.

2. Using a pointed tool, remove lock ring from groove while holding cup down.

3. Invert lifter and slide out push rod cup, metering disc, plunger, ball, small spring, ball retainer, and spring.

If plunger is stuck in lifter body, place lifter, push rod end down, in Valve Lifter Plunger Remover, J-4160, Fig. 6-189. Holding tool firmly in hand with thumb over

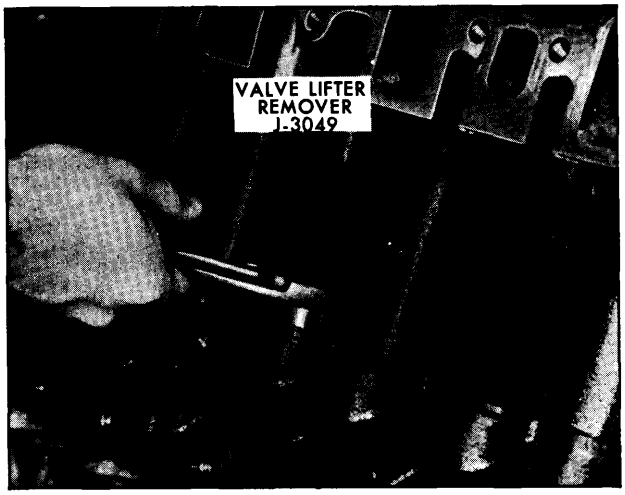


Fig. 6-188 Removing Valve Lifters

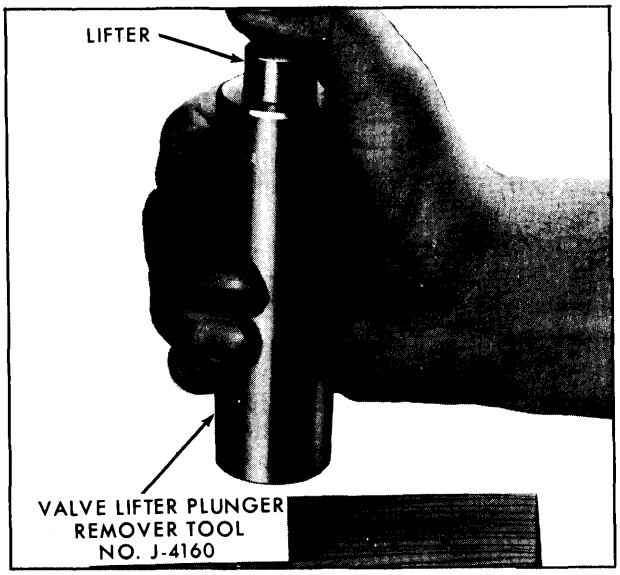


Fig. 6-189 Removing Stuck Plunger from Body

lifter body, strike tool sharply on block of wood or wooden bench until plunger falls out of body.

b. Assembly

1. Place ball on its seat in lower end of plunger while holding plunger upside down. Place small spring on ball.

2. Position ball retainer over small spring and ball and snap into recess in plunger.

3. Place spring over ball retainer.

4. Lower lifter body over plunger assembly on an angle to seat spring.

5. Turn assembly right side up and fill plunger with clean engine oil.

6. Jiggle ball with small piece of wire until oil drains out of plunger into body and trapped air is released from body.

7. Refill plunger with oil, place oil metering disc and push rod cup on plunger, and position lock ring over cup.

8. Press lock ring into groove with Valve Lifter Lock Ring Installer, J-2730, Fig. 6-190.

120. Valve Spring or Oil Shedder Replacement

a. Removal

1. Remove air cleaner.

2. Remove rocker arm cover as described in Note 115a.

3. Remove rocker arm assembly from cylinder head.

4. Remove push rods.

5. Remove spark plug.

6. Connect air hose to Adapter J-22794 and supply air to cylinder.

7. Install rocker arm support screw.

8. Install Valve Spring Compressor, J-22765, over rocker arm stand screw, Fig. 6-191.

9. Compress valve spring and remove locks from valve stem.

BACK TO INDEX

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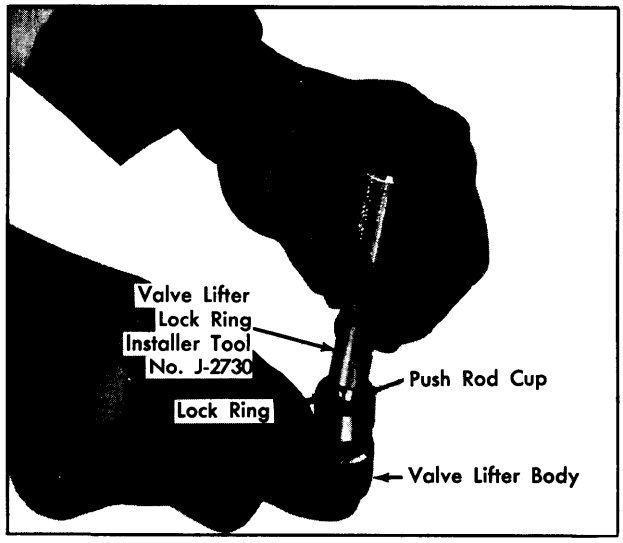


Fig. 6-190 Lock Ring Installation

(NOTE: A sharp blow on a socket placed on top of the retainer will help break loose any stuck locks.)

10. Lift out spring retainer with nylon shedder and spring, Fig. 6-192. Discard retainer-shedder.
11. Clean gasket material off cylinder head and rocker arm cover.

b. Installation

1. Install valve spring and new retainer-shedder assembly, Fig. 6-192.
2. Using Valve Spring Compressor, J-22765, compress valve spring and install locks, Fig. 6-192.
3. Bleed air out of cylinder and remove air hose and Adapter, J-22794.
4. Install spark plug.
5. Remove rocker arm support screw.



Fig. 6-191 Compressing Valve Spring

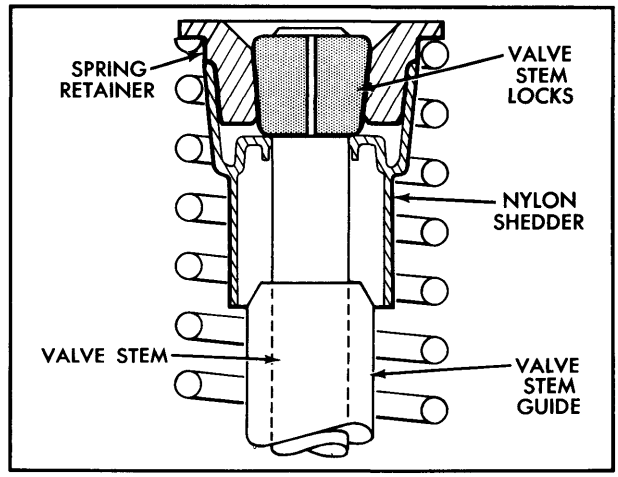


Fig. 6-192 Valve Spring Retainer

6. Install push rods.
7. Position rocker arms on rocker arm support. Fig. 6-193.
8. Position retainer on rocker arm supports.
9. Position rocker arm assembly on cylinder head and secure with screws. Tighten screws to 60 foot-pounds.
10. Position new rocker arm cover gasket on cover.
11. Install rocker arm cover as described in Note 115b.
12. Install air cleaner, making sure heat duct engages heat shroud on exhaust manifold.
13. Run engine and check for oil leaks.

121. Cylinder Head

a. Removal

1. Drain cooling system.
2. Remove intake and exhaust manifolds as described in Notes 113a and 114a respectively.
3. Remove rocker arm covers as described in Note 115a.

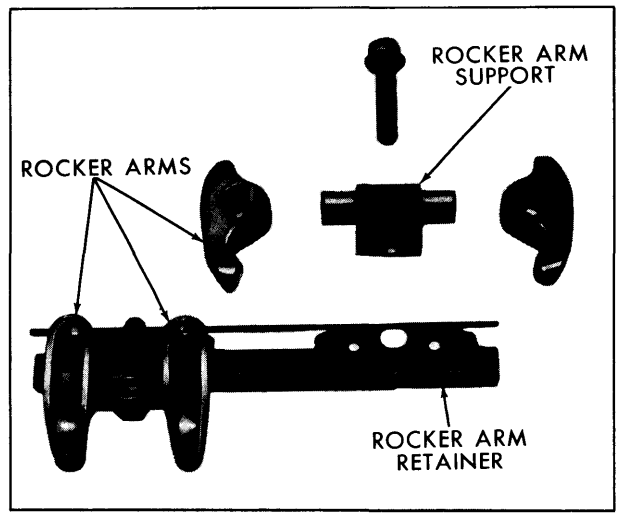


Fig. 6-193 Rocker Arms Disassembled

BACK TO INDEX

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4. Disconnect electrical and ground connections from cylinder head.

5. Partially remove power steering pump as described in Section 9, Note 7a, if working on left cylinder head.

6. If working on right head, remove heater hose from rear of head. Remove generator as described in Note 37, and remove A.I.R. pump, if so equipped, as described in Note 99.

7. Remove screws securing rocker arm supports to cylinder head.

8. Remove rocker arm assemblies. Store assemblies so that they can be reinstalled in same location.

9. Remove push rods.

10. Install two 7/16-14 x 6" screws, to be used as lifting handles, in two of the rocker arm support screw holes.

11. Remove ten cylinder head screws and lift head from block.

12. Carefully remove all gasket material from mating surface of cylinder head and cylinder block and cylinder head and rocker arm cover mating surfaces.

b. Installation

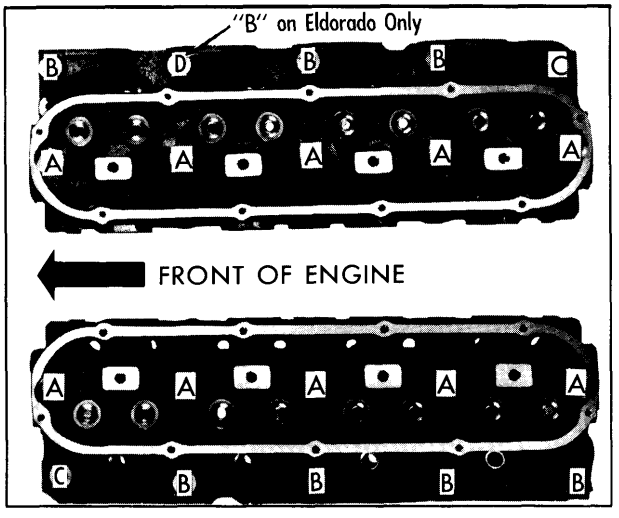
1. Use extreme caution to insure that all mating surfaces of cylinder head and cylinder block are clean.

2. Position cylinder head gasket over dowels on cylinder block.

3. Position cylinder head on cylinder block.

4. Install ten cylinder head screws finger tight in locations as indicated in Fig. 6-194.

5. Tighten cylinder head screws to 115 foot-pounds starting from center of cylinder head and working toward both ends.



Bolt Location	Length
A (Bolt)	4.36" (Medium)
B (Bolt)	4.77" (Long)
C (Bolt)	3.02" (Short)
D (Bolt/stud)	4.77" (Long)

Fig. 6-194 Cylinder Head Screws

6. Remove two 7/16-14 x 6" screws used for lifting handles.

7. Install push rods through openings in cylinder head. Bottom of push rod must be seated in hydraulic valve lifter cup.

8. Position rocker arm assemblies on cylinder heads in same positions as found on disassembly and secure with screws. Tighten screws to 60 foot-pounds, Fig. 6-194.

9. Install rocker arm cover as described in Note 115b.

10. Install exhaust and intake manifolds as described in Notes 113b and 114b respectively.

11. If working on left cylinder head, install power steering pump as described in Section 9, Note 7b. Connect high temperature warning wiring connector at rear of head.

12. If working on right cylinder head, install A.I.R. pump, if so equipped, as described in Note 99, install generator as described in Note 37, and connect heater hose at rear of head.

13. Refill cooling system.

14. Start engine and allow it to reach normal operating temperature. Check torque on rocker arm cover screws. Check for coolant and oil leaks.

122. Valve (Intake or Exhaust

a. Removal

1. Remove cylinder head as described in Note 121a.

2. Set cylinder head on clean work bench. Position cylinder head on intake manifold surface.

3. Position valve spring compressor over valve, Fig. 6-195 and compress valve spring.

4. Remove valve locks.

5. Slowly release tension on valve spring compressor and remove compressor.

6. Remove valve spring retainer with nylon shedder and spring, from cylinder head. Discard valve spring retainer-shedder assembly.

7. Remove valve from cylinder head.

8. Repeat Steps 3 through 7 for remaining valves to be serviced.

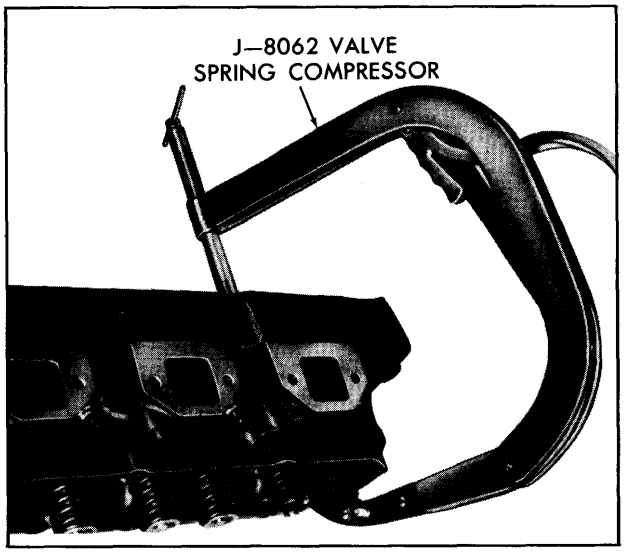


Fig. 6-195 Removing Valve

BACK TO INDEX

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b. Installation

1. Position valve and spring onto cylinder head.
2. Position new valve spring retainer-shedder assembly on valve stem.
3. Engage valve and retainer with valve spring compressor, Fig. 6-195, and compress valve spring.
4. Install valve locks on valve stems.
5. Slowly release tension on valve spring compressor and remove valve spring compressor.
6. Repeat Steps 1 through 5 for remainder of valves to be installed.
7. Install cylinder head on engine as described in Note 121b.

123. Valve and Seat Reconditioning

Valve reconditioning is normally required less frequently in engines having hydraulic valve lifters. When this work is done, the close limits given in the engine specifications, Pages 6-184 and 6-185 must be maintained.

Check valve stem to guide clearance using a hole gage and an outside micrometer. Measure valve guide inside diameter with hole gage, crossways to engine, at both top and bottom of guide, measuring gage each time with micrometer. A standard size valve guide is .343" in diameter.

Measure valve stem diameter with micrometer and subtract from greater of two guide measurements to obtain maximum clearance. If clearance is greater than .005 inch, guide should be reamed to oversize to prevent excessive oil consumption and improper seating of valves.

An alternate method of checking valve stem to guide clearance, if a hole gage is not available, is by using a 1/16 inch wide strip of .005 inch brass shim stock on a "no-go" basis.

Bend end of shim and hang in end of valve guide, with tip extending towards push rod side of head. Shim should not extend more than 1/4 inch into guide. If valve stem will enter guide, clearance is excessive and guide should be reamed to oversize.

Service valves are available in standard (.343") and +.003", +.006", +.013" sizes. If clearance is found to be excessive as described above, guide should be reamed to the next oversize using the appropriate reamer, and a valve having a corresponding oversize stem should be installed.

The following tools are recommended for the reaming operation:

Size	Tool Number
+.003" (.346")	J-5830-1
+.006" (.349")	J-5830-6
+.013" (.356")	J-5830-7

Valves with a .003" oversize diameter and .003" oversize valve guides are installed at the factory on some engines. Engines so fitted will be marked by a "3" stamped on the cylinder head gasket surface in line with the oversize valve.

All oversize service valves will be so marked on the valve head so that they may be easily identified when part numbers are not available.

When an oversize valve is installed, be sure to stamp the oversize marking on the cylinder head gasket surface, as explained above, for future reference.

Check concentricity of all valve seats. This should be within .004 inch total, as measured with dial indicator and a solid, slightly tapered pilot which has a slight bind in the valve guide when installed.

CAUTION: A pilot of the correct size must be used. Do not attempt to drive pilot into guide. Pilots with adjustable diameters to fit various sized guides are not recommended as valve guide damage could result.

Grind valve seats to within .002 inch indicator reading when new valves are being installed, or if concentricity, seat width, or full contact of valves is not as specified.

Check seat width and location on valve to insure proper heat dissipation and prevent build up of carbon on seats. Condition valve seat to a width of 3/64 to 1/16 inch. This seat width will insure good idle stability.

Valve seats should be cut on a 45° angle so that the seat is 1/16 inch smaller in diameter than the valve head, Fig. 6-196, to allow heat to escape and to provide maximum life for newly ground valves. The diameter of the seat can be checked by placing valve in position and then rotating to get a contact pattern with the seat.

New valves have a face angle of 44° to provide a line contact between the head of the valve and the valve seat in the cylinder head, which assures good seating of the valve and less chance of burning the valve head due to exhaust gas leakage. When reconditioning valves, always grind valve face angle to 44°.

Service valves should not have more than 1/16 inch wide contact with valve seats (due to 1° difference in angle) and should not be ground as they are ready to use as received. Grinding of valves by hand with grinding compound or lapping to seat them is not recommended. Use only precision equipment for valve and seat reconditioning, and follow equipment manufacturer's instructions.

124. Engine Oil Pan

a. Removal

1. On Eldorados, drain oil, remove engine from vehicle chassis as described in Note 110a, and proceed with Steps 9 and 10.

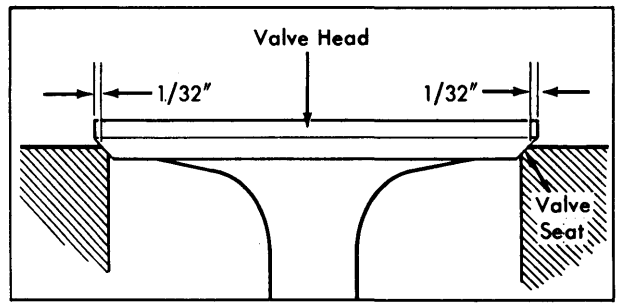


Fig. 6-196 Valve Seat Grinding

BACK TO INDEX

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2. Disconnect negative battery cable.
3. Raise car on hoist.
4. Drain engine oil.
5. Remove exhaust "Y" pipe at exhaust manifold as described in Section 8.
6. Remove starter motor as described in Note 25a.
7. Remove two idler arm support mounting screws and lockwashers from frame side member, and lower support.
8. Disconnect pitman arm at center link, using Puller, J-8990, and lower steering linkage.
9. Remove transmission lower cover.
10. Remove nuts and cap screws that hold oil pan to cylinder block and remove oil pan.
11. Remove side gaskets and rubber front and rear seals from oil pan, and discard.

b. Installation

1. Cement new gasket to both sides of oil pan, with gasket cement lining up holes in gaskets with holes in oil pan flange.
2. Thoroughly clean front and rear seal surfaces of oil pan, and install new oil pan front and rear seals by pulling locating tangs on seals through locating holes in seal flange. Make sure seals are firmly positioned on flange surfaces with ends of each seal properly located in cut-out notches in side gaskets.
3. Seal all four corner notch openings with a coating of gasket cement.
4. Clean out notches in block where ends of oil pan rear seal fit. Fill this rectangular cavity with Transmission Cooler Hose Cement.

(NOTE: This cement will be easier to apply if the tube has been stored in a cool location to prevent the contents from becoming too thin.)

5. Position oil pan on bottom surface of cylinder block and install cap screws and nuts tightening to 10 foot-pounds.
6. On Eldorados, install engine as described in Note 110b and proceed with Step 12.
7. Install transmission lower cover and secure with four cap screws. Tighten screws to 20 foot-pounds.
8. Connect pitman arm to center link.
9. Secure idler arm support mount to frame with two attaching screws and lockwashers. Tighten screws to 35 foot-pounds.
10. Secure starter motor to cylinder block as described in Note 25b.
11. Install exhaust "Y" pipe as described in Section 8.
12. Lower car.
13. Add four quarts engine oil to crankcase. Use five quarts on Eldorado. Check oil dipstick for proper oil level.
14. Connect negative battery cable.
15. Run engine and check for leaks at all connections.

125. Oil Pump Servicing

a. Removal

1. Raise car.
2. Remove oil filter.
3. Remove five screws securing oil pump to engine, Fig. 6-197. The screw nearest the pressure regulator should be removed last, allowing the pump to come down with screw. Discard oil pump to crankcase gasket.
4. Remove pump drive shaft.

b. Disassembly

1. Slide drive shaft, drive gear, and driven gear out of pump housing.
2. Using a 5/16 inch hex head wrench, remove plug from pump housing assembly, and remove oil pressure regulator valve and spring from bore in housing assembly.

c. Inspection

1. Inspect oil pressure regulator valve for nicks and burrs that might cause a leak or binding condition in bore of pump housing.
2. Check free length of regulator valve spring. It should be approximately 2.57 inches to 2.69 inches in length. A force of 9.3 to 10.5 pounds should be required to compress the spring to 1.46 inches.
3. Inspect drive gear and driven gear for nicks and burrs.
4. Inspect pump housing for wear and score marks.
5. Check pump mating surfaces on engine block for wear and score marks.

d. Assembly

1. Install oil pressure regulator valve and spring in bore of pump housing assembly.
2. Using a 5/16 inch hex head wrench, install plug in housing assembly and tighten plug to 30 foot-pounds.
3. Install pump drive gear over lower shaft in pump housing.
4. Slide driven gear over remaining shaft in pump housing, meshing driven gear with drive gear.

(NOTE: The hex markings on both gears should be installed upwards toward the crankcase.)

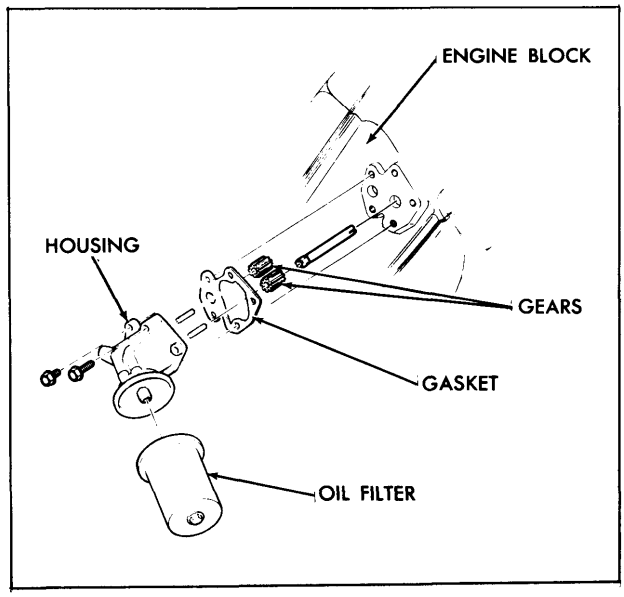


Fig. 6-197 Oil Pump Disassembled

BACK TO INDEX
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e. Installation

1. Pack pump with petrolatum.
2. Position new gasket on pump housing.
3. Engage pump drive shaft with distributor drive and guide into oil pump drive gear.
4. Install pump to engine by allowing it to ride up as screw nearest pressure regulator is turned in.
5. Install remaining four screws. Tighten all five screws to 15 foot-pounds.
6. Install oil filter and add 1 quart engine oil to crankcase.
7. Run engine (oil pressure light should go out) and check for leaks in pump area.
8. Lower car.

126. Rear Main Bearing Oil Seal Replacement

Rear main bearing seal installation can be properly accomplished by using a simple, easily made tool, Fig. 6-198. Make the tool out of a metal banding strap or shim stock. The tool will act as a "shoehorn" to protect the backbone or outer diameter of the seal from scraping against the sharp edge of the cylinder block. Replacement procedure is as follows:

1. Disconnect spark plug wires and remove spark plugs.
2. Raise car.
3. Remove oil pan as described in Note 124a.
4. Loosen two screws that hold rear main bearing cap to cylinder block and remove cap with screws.
5. Remove lower seal half from bearing cap and discard.
6. Rotate upper seal half by pushing on one end with sharp object, and remove upper seal half from cylinder block.
7. Inspect grooves in bearing cap and cylinder block to be sure they are clean, dry, and free from burrs.

(NOTE: The two seal halves are identical and can be used in either the lower or upper location. Both seal halves are pre-lubricated with a film of wax for break-in. Do not remove or damage this film.)

8. To install lower half of seal into the bearing cap, slide either end of seal into position at one end of bearing cap and place tool in groove at other end of bearing, Fig. 6-199. Make sure the seal is positioned in the groove and the lip of the seal is facing forward (car position).
9. Hold thumb or finger over end of seal that is flush with split line to prevent it from slipping upward, and push seal into seated position by applying pressure to the other end.
10. Make sure seal is pressed down firmly and is flush on each side to avoid possibility of a leak at the seal split line. Avoid pressing on lip as damage to sealing edge could result.
11. To install upper half of seal in cylinder block (with crankshaft in car), position "shoehorn" in groove of block. Lubricate seal and start into groove in block with lip facing forward. Rotate seal into position, using care not to distort it, Fig. 6-199.
12. Do not press on lip or sealing edge of seal may be damaged. Also, both ends of seal should be flush at the seal split line to avoid leaks.
13. If necessary, Lubriplate, or its equivalent, may be used to facilitate installation of both lower and upper half of seal. Do not use silicone or an oil leak may result.
14. Install bearing cap and secure with attaching screws. Tighten screws to 95 foot-pounds.
15. Rotate crankshaft 360° to make sure crankshaft is not binding.
16. Install oil pan as described in Note 124b.
17. Install spark plugs and tighten to 25 foot-pounds. Connect spark plug wires.
18. Run engine and check for oil leaks.
19. Lower car.

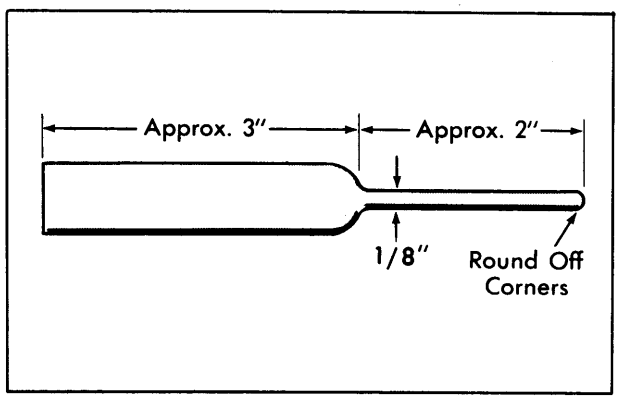


Fig. 6-198 Main Bearing Oil Seal Tool

127. Crankshaft Pulley and Hub

a. Removal

1. Disconnect negative battery cable.
2. Drain coolant from radiator.
3. Loosen hose clamp at radiator inlet (top) and remove one screw securing hose to radiator cover. Position upper radiator hose out of way.
4. Remove fan blade assembly as described in Note 7a or 8b.
5. Remove generator belt and power steering pump belt.

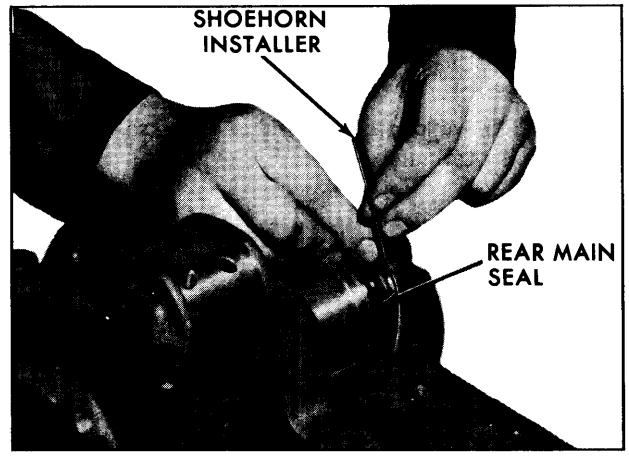


Fig. 6-199 Installing Rear Main Oil Seal

BACK TO INDEX

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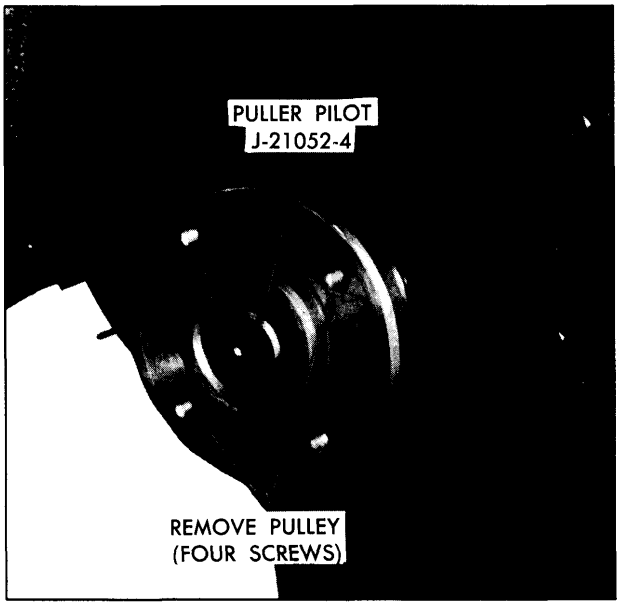


Fig. 6-200 Installing Balancer Hub Pilot

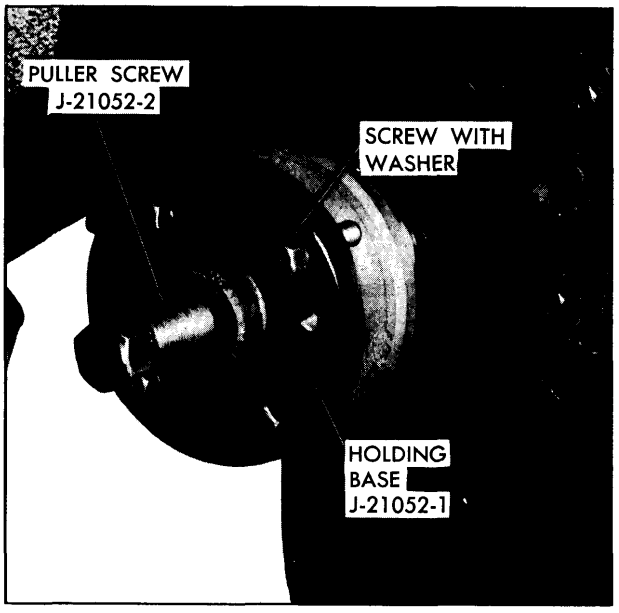


Fig. 6-201 Removing Balancer Hub Pilot

6. Remove four cap screws that hold crankshaft pulley and remove pulley.
7. Remove plug from end of crankshaft.
8. Install Puller Pilot, J-21052-4, in bore in end of crankshaft, Fig. 6-200.
9. Install Holding Base, J-21052-1, on front of hub, lining up holes on base with screw holes in hub, and install four holding screws with washers finger tight, Fig. 6-201. Do not use a wrench to tighten screws.

(NOTE: The base will bolt to the hub in only one position. Do not install screws if they must be slanted.)

10. Thread Puller Screw, J-21052-2, into base until screw contacts pilot.
11. Using a wrench, remove hub from crankshaft by tightening screw, Fig. 6-201.

(NOTE: Use of shop air pressure to hold one piston within its compression stroke may be necessary to remove hub without turning the crankshaft. Remove a spark plug, install Adapter J-22794, in spark plug port, and apply air pressure to hold piston within its compression stroke.)

12. Remove pilot from end of crankshaft and remove Puller from hub.

b. Installation

1. Lubricate bore of hub and seal with E.P. lubricant to prevent seizure to crankshaft.
2. Position hub on crankshaft, lining up to key slot in hub with key on crankshaft.
3. Place Holding Base, J-21052-1, against front face of pulley and thread Installer Screw, J-21052-5, into end of crankshaft. Position thrust bearing with inner race forward, washer next, and Installer Nut, J-21052-6, last, Fig. 6-202.
4. Using a wrench, install hub on crankshaft by tightening screw.

(NOTE: Use of shop air pressure, as explained in removal procedure, may be necessary to install hub assembly without turning crankshaft.)

5. Install crankshaft pulley to hub and secure with four screws. Tighten all four screws to 15 foot pounds.
6. Exhaust air pressure from cylinder, remove Adapter, J-22794, and install spark plug.
7. Install pulley and fan blade assembly on water pump as described in Note 7b or 8b.
8. Install power steering pump belt and generator drive belt on pulleys.

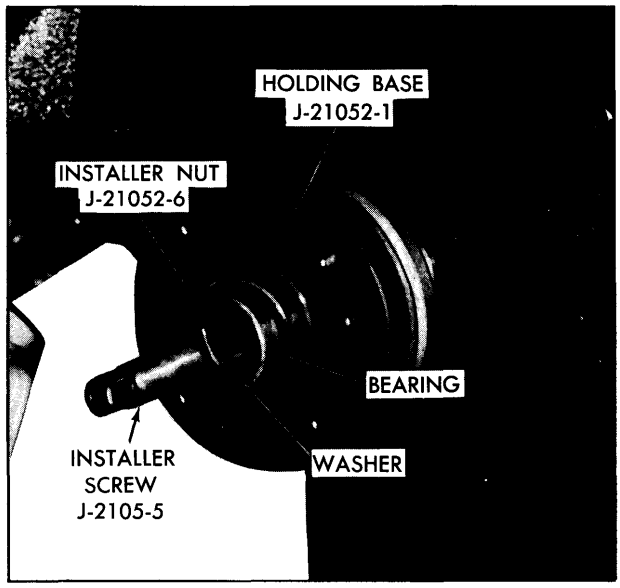


Fig. 6-202 Installing Balancer Hub

BACK TO INDEX

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9. Adjust all belts as described in Note 10.
10. Connect upper radiator hose at radiator inlet pipe and secure with hose clamp. Secure hose to radiator cover with one screw.
11. Lower car.
12. Refill cooling system with coolant.
13. Reconnect negative battery cable.
14. Run engine to check for coolant and oil leaks.

128. Engine Front Cover

Engine operations requiring removal of the front cover (such as camshaft replacement) may use the following procedure which eliminates the necessity of removing the oil pan. Close adherance to the procedure is required to avoid oil leaks.

a. Removal

1. Remove crankshaft pulley hub as described in Note 127a.
2. Loosen starter sufficiently to gain access to oil pan screws.
3. Loosen oil pan nuts and screws and lower front of oil pan.
4. Loosen hose clamp at water pump inlet and remove lower radiator hose from water pump.
5. Remove 10 screws that hold front cover to cylinder block and remove cover with water pump attached. Discard gasket.

b. Installation

1. Inspect oil pan front seal to make sure that it was not damaged during removal of cover. If damaged, seal should be replaced. If seal is in satisfactory condition remove any oil from seal and coat sealing surface with gasket cement.
2. Position new front cover gasket over locating dowels on cylinder block.

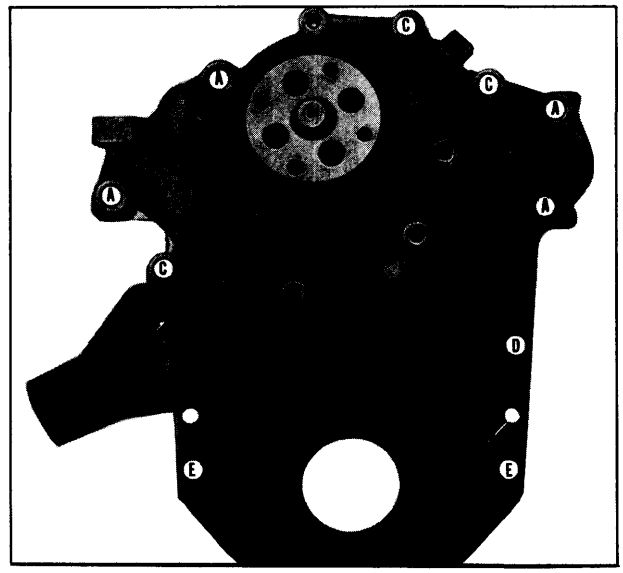
(NOTE: Apply a small amount of gasket cement to hold gasket in place).

3. Work front cover over end of crankshaft and down into position over oil pan lip. Align dowel holes in cover with locating dowels on cylinder block. Secure with attaching screws. Refer to 6-203 for proper screw location and torque specifications.
4. Install crankshaft pulley hub as described in Note 127b.
5. Tighten oil pan nuts and screws to 10 ft. lbs. and tighten starter motor mounting screws to 45 ft. lbs.
6. Install lower radiator hose to water pump inlet and secure with hose clamp.
7. Refill cooling system and add engine oil.
8. Run engine and check for leaks.

129. Front Cover Oil Seal Replacement (Fig. 6-204)

a. Removal

1. Remove crankshaft pulley and hub as described in Note 127a.



Key	(No.)	Size	Torque
A	(4)	3/8-16 x 1-3/8	22 Foot-Pounds
C	(3)	5/16-18 x 1-1/4	10 Foot-Pounds
D	(1)	5/16-18 x 5/8	10 Foot-Pounds
E	(2)	3/8-16 x 5/8	22 Foot-Pounds

Fig. 6-203 Front Cover Attaching Screws

2. With thin-bladed screwdriver or similar tool, pry out front cover oil seal. Discard seal.

b. Installation

1. Lubricate new oil seal by filling the cavity between the lips with wheel bearing grease. Position seal on end of crankshaft with garter spring side toward engine.

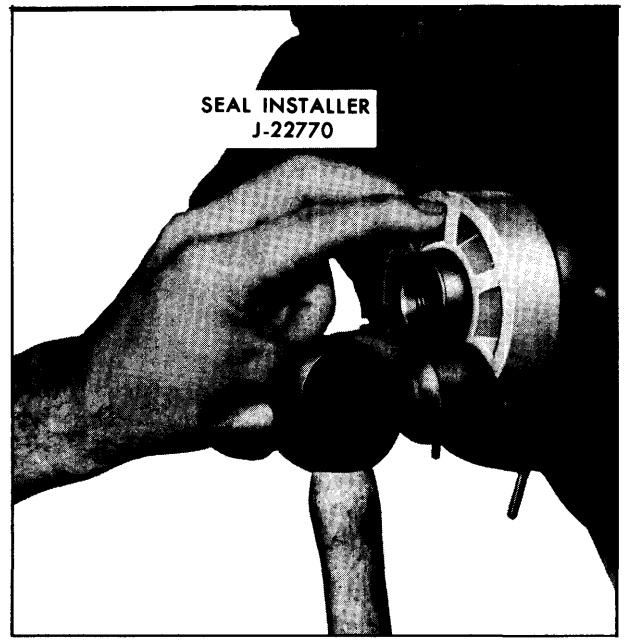


Fig. 6-204 Installing Front Cover Oil Seal

BACK TO INDEX
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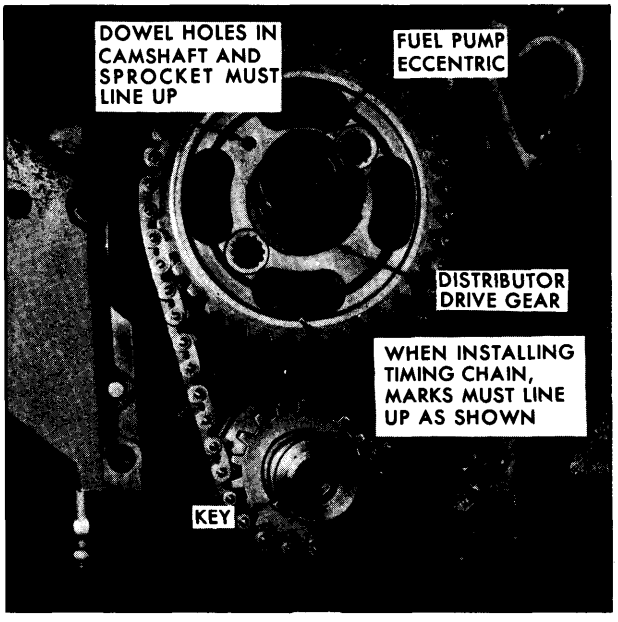


Fig. 6-205 Timing Sprockets

2. Using Seal Installer, J-22770, and hammer, drive seal into front cover until it bottoms against front cover, Fig. 6-204.

3. Install crankshaft pulley and hub as described in Note 127b.

130. Camshaft

a. Removal

1. Remove radiator as described in Section 13, Note 1a.
2. Remove engine front cover as described in Note 128a.
3. Remove ignition distributor as described in Note 32a.
4. Remove oil pump as described in Note 125a.
5. Remove oil slinger from crankshaft.
6. Remove fuel pump as described in Note 68a.
7. Remove screw securing fuel pump eccentric to camshaft and remove eccentric.
8. Remove two screws securing camshaft sprocket to camshaft.
9. Remove camshaft sprocket with chain attached.
10. Remove valve lifters as described in Note 118a.
11. Slide camshaft forward carefully until it is out of engine.

CAUTION: Extreme care must be exercised to keep cam lobes from scratching camshaft bearings.

b. Inspection

The camshaft is made of alloy cast iron. It must be handled with particular care to avoid damage.

Whenever camshaft has been removed from engine, or faulty camshaft action is suspected in diagnosing engine conditions, the camshaft lobes should be visually checked for wear. This may be done with camshaft installed in engine by removing hydraulic lifters and noting condition of camshaft lobes. Excessive wear, scoring, or flaking of the lifter will usually denote camshaft wear. Excessive camshaft wear is evidenced by grooves, scoring, or flaking. Camshaft should be replaced if any of these conditions exist.

Bearing journals should not be scored or burned. Camshaft bearings should be visually inspected in their bores for excessive wear.

c. Installation

1. Apply a thin coat of rear axle lubricant to all camshaft lobes and bearing journals.
2. Guide camshaft carefully into cylinder block.

CAUTION: Extreme care must be exercised to avoid nicking or scratching camshaft bearings.

3. Install valve lifters as described in Note 118b.
4. Install camshaft sprocket in timing chain with timing mark toward front.
5. Place chain over crankshaft sprocket and line up timing marks on both sprockets, Fig. 6-205.

(NOTE: Engine is being timed so that cylinder #4 is in the firing position.)

6. Hold camshaft sprocket in position against end of camshaft and press sprocket on camshaft by hand, being sure index hole in camshaft is lined up with index hole in sprocket.
7. Install two screws and lockwashers securing camshaft sprocket to camshaft. Tighten screws to 18 foot-pounds.
8. Install fuel pump eccentric on camshaft and secure with screw. Tighten screw to 35 foot-pounds.
9. Install fuel pump as described in Note 68b.
10. Install oil slinger on crankshaft with smaller end of slinger against crankshaft sprocket.
11. Install engine front cover as described in Note 128b.
12. Install ignition distributor as described in Note 32b.

(NOTE: Engine timing has been set so that cylinder #4 is in the firing position. When installing the distributor, either set the rotor so that cylinder #4 is firing or crank the engine 360° as observed at crankshaft and set ignition timing on cylinder #1.)

13. Install oil pump as described in Note 125b.
14. Install radiator as described in Section 13, Note 1b.

131. Camshaft Bearing Replacement

Babbitt type camshaft bearings are used on all engines. Whenever camshaft has been removed from engine for inspection, these bearings should be visually inspected in their bores for excessive wear. If excessive wear is evident, all five bearings should be replaced. A precision pre-machined camshaft bearing, interchangeable bore to bore, is available for field replacement.

BACK TO INDEX

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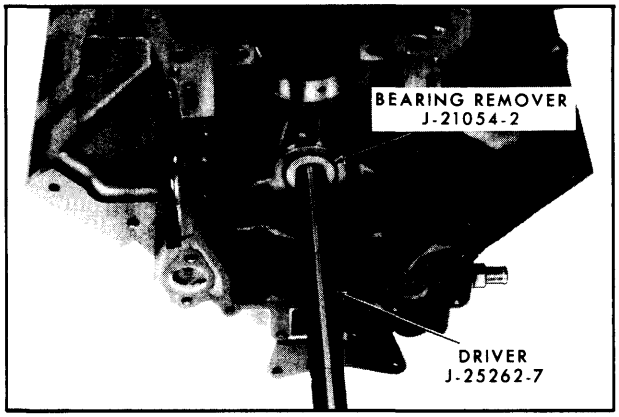


Fig. 6-206 Removing Camshaft Bearings

a. Removal

1. Remove camshaft as described in Note 130a.
2. Thread Arbor, J-21054-2 on end of Drive Shaft, J-25262-7, and position shoulder of arbor against front face of No. bearing, Fig. 6-206.
3. Using a hammer, drive out No. 1 bearing through rear face of bearing bore. Remove bearing from arbor and discard.
4. Place Pilot J-25262-6 on Handle J-25262-7 and position pilot in No. 1 cam bearing journal in block.
5. Position Arbor J-21054-2 to No. 2 cam bearing and drive bearing out of block.
6. Remove remaining three bearings in same manner. When removing No. 5 bearing, drive out rear cup plug, located behind No. 5 bearing, along with bearing.

b. Installation

1. Install new cup plug in rear of No. 5 bearing bore and seal plug with a permanent type sealer.
2. Locate center oil passage in each bearing bore and scribe a reference mark on front face of each bore, Fig. 6-207.
3. Slide Drive Shaft, J-25262-7, with Arbor, J-21054-2, through No. 1, 2, 3, and 4 bearing bores until arbor is positioned between No. 4 and No. 5 bores.

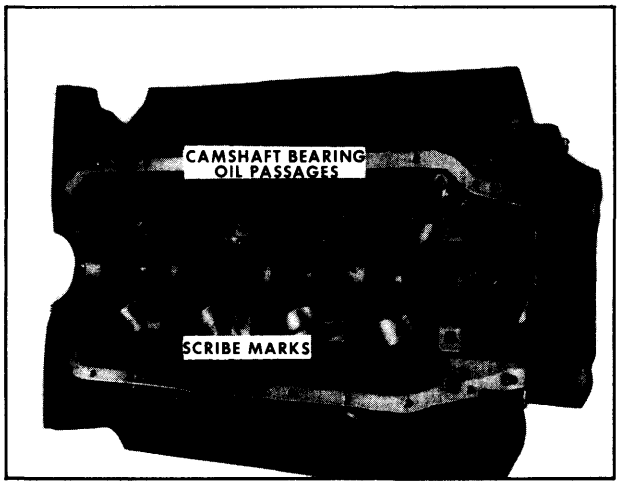


Fig. 6-207 Camshaft Bearing Oil Passages

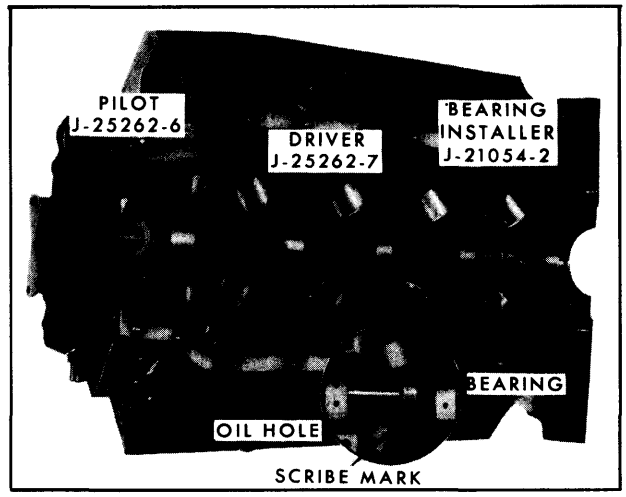


Fig. 6-208 Installing Camshaft Bearings

4. Slide Pilot J-25262-6 in position in No. 1 cam bearing journal.
5. Place new bearing on Arbor and position in No. 5 bearing bore, lining up oil hole in bearing with scribe mark on front face of bore, Fig. 6-208.
6. Using a hammer, install bearing in bore until the last white line on the Driver J-25262-7 is flush with the front face of Pilot J-25262-6.

(NOTE: Use only line labeled 500).

7. Place No. 4 bearing on Arbor J-21054-2, align oil hole and drive in until next white line is flush with pilot.

(NOTE: Use only lines labeled 500).

8. Following the same procedure install No. 3 and No. 2 bearings.
9. Install No. 1 bearing using only Driver J-25262-7 and Arbor J-21054-2.
10. Check alignment of bearing oil holes by looking down oil hole.
11. Install camshaft as described in Note 130c.

132. Crankshaft

a. Removal

1. If working on Eldorado, remove engine from vehicle chassis as described in Note 110a. Proceed to Step 3.
2. Raise car.
3. Remove oil pan as described in Note 124a.
4. Remove timing chain and sprockets as described in Note 130a Steps 1 through 8.
5. Remove screws and nut securing oil pick-up tube and strainer assembly to cylinder block and remove intake screen assembly. Discard O-ring.
6. On all cars except Eldorado remove transmission as described in Section 7, Note 11.
7. Remove six screws that hold flywheel to crankshaft and remove flywheel.
8. Remove spark plugs.
9. Disconnect connecting rods and, using Connecting Rod Guide Set, J-3224, to protect journals, push pistons up into cylinders so that crankshaft can be removed without interference.

BACK TO INDEX
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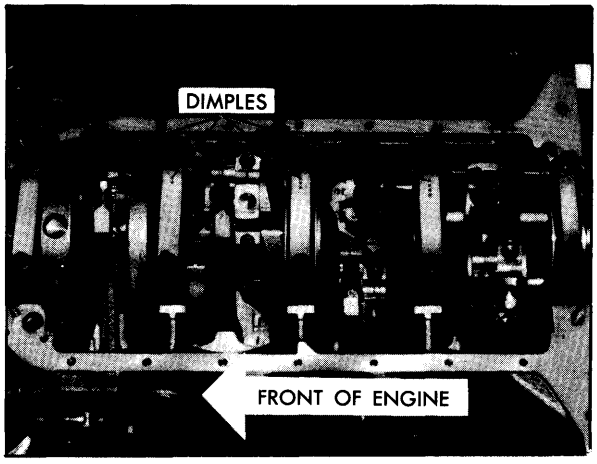


Fig. 6-209 Main Bearing Caps

10. Remove front and rear main bearing caps.
11. Support crankshaft at front and rear and remove three intermediate bearing caps.
12. Remove crankshaft from engine.

b. Installation

1. Place crankshaft in position and support in place while installing main bearing caps as described in Note 139. Use a new rear main bearing oil seal as described in Note 126.

(NOTE: Each bearing cap has a number of dimples (1, 2, 3, 4) machined on bottom starting from the front of the engine as shown in Fig. 6-209. Do not mismatch these caps or turn them around because they are individually matched as the cylinder block is machined.)

2. Lubricate crankpins with engine oil and pull connecting rods down toward crankshaft. Use Connecting Rod Guide Set, J-3224, to protect journals.
3. Install connecting rods on crankshaft as described in Note 133.
4. Install oil pick-up tube and strainer assembly with new O-ring on cylinder block and secure with two screws and nut. Tighten to 18 foot-pounds.
5. Install flywheel and secure with six screws. Tighten screws to 75 foot-pounds.
6. On all cars except Eldorado, install transmission as described in Section 7, Note 11.
7. Install spark plugs. Tighten to 25 foot-pounds.
8. Install timing chain and sprockets as described in Note 130c.
9. Install oil pan as described in Note 124b.
10. Lower car.
11. If working on Eldorado, install engine in vehicle chassis as described in Note 110b.

133. Connecting Rod and Piston

a. Removal

1. If working on Eldorado, remove engine from vehicle chassis as described in Note 110a.

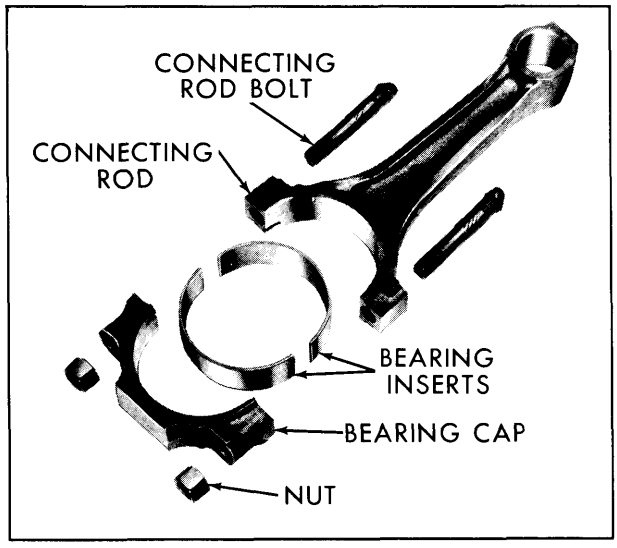


Fig. 6-210 Connecting Rod and Bearing

2. Remove cylinder heads as described in Note 121b.
3. Clean carbon from top of cylinder bore. Ream upper ridges if necessary to prevent breakage or distortion of piston ring lands due to rings catching in the ridge. Pack cylinder bore with cloth to catch shavings.
4. Remove oil pan as described in Note 124a.
5. Remove two cap screws and nut that hold oil pick-up tube and strainer assembly to cylinder block. Discard O-ring.
6. Remove connecting rod cap by removing connecting rod nuts and sliding cap down off connecting rod bolts, Fig. 6-210.
7. Install Connecting Rod Guide Set, J-3224, on connecting rod bolts.

CAUTION: Be careful not to damage crankshaft or cylinder bore when removing piston and rod assembly.

8. Push connecting rod and piston assembly up until piston rings are out of bore, and remove piston and connecting rod assembly from engine.

CAUTION: Be careful not to nick lower edge of bore when pushing rod up.

9. Remove remaining seven piston and connecting rod assemblies in same manner.

b. Installation

1. Removing connecting rod cap from connecting rod and install bearing inserts in both cap and rod, being careful to locate bearing tangs in locating notches.
2. Install Connecting Rod Guide Set, J-3224, on rod bolts to protect crankpin journals.
3. Using Piston Ring Compressor, J-22748, position capless rod and piston in cylinder bore with notch toward front of engine (letter "R" on piston toward rear) as shown in Fig. 6-211.
4. Using wood hammer handle, tap piston and connecting rod down into position on crankpin, Fig. 6-212. and remove Connecting Rod Guide Set, J-3224.

BACK TO INDEX

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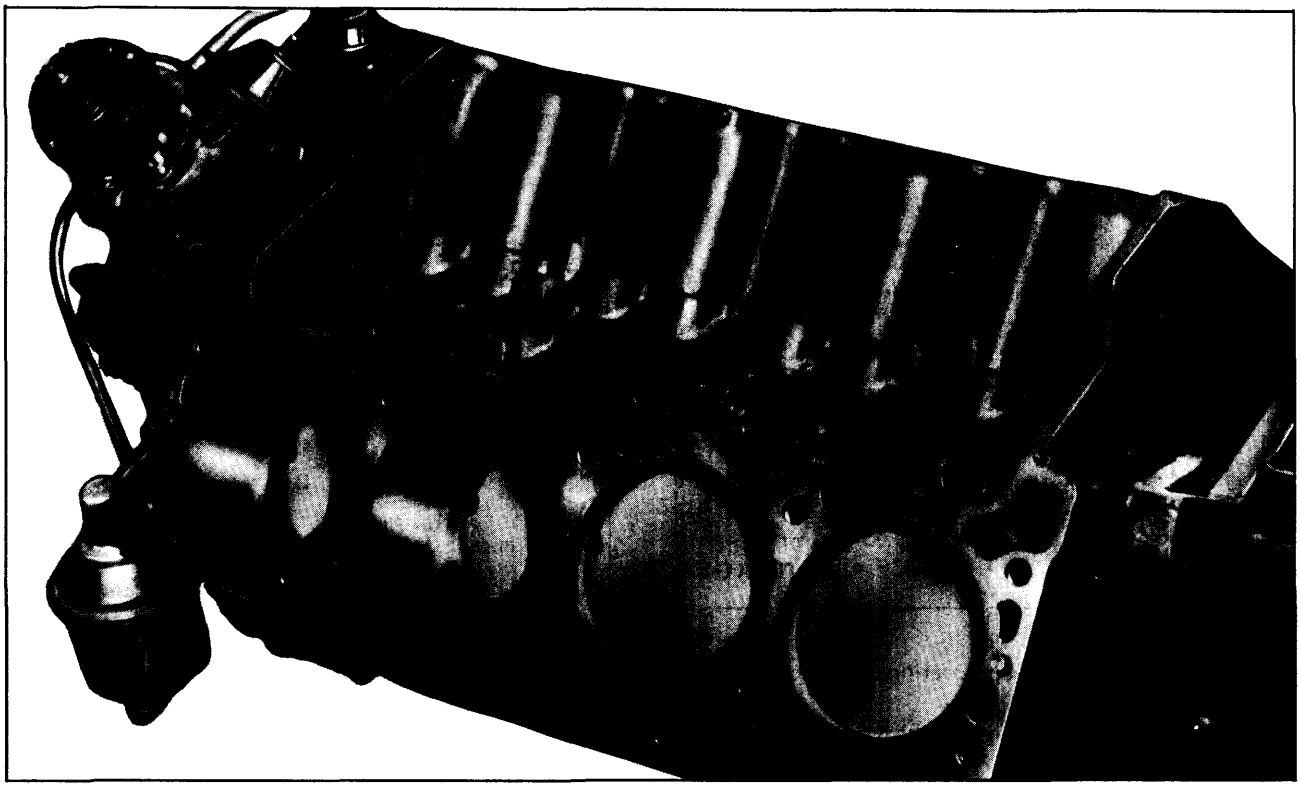


Fig. 6-211 Engine Partially Disassembled (Typical)

CAUTION: Extreme care must be exercised when installing pistons and rods to be sure rod is lined up with crankshaft journals and does not stick or bind on counterweights.

5. Install connecting rod cap with bearing in place over connecting rod bolts, making sure numbered side of cap is on same side as numbered side of rod.

6. Install remaining seven piston and connecting rod assemblies in the same manner.

(NOTE: Recheck to see that numbered sides of connecting rods on Nos. 1, 3, 5, and 7 rods are on right side of engine and Nos. 2, 4, 6, and 8 are on left side of engine, and that rods are on proper crankpin.)

7. Install rod cap nuts and tighten to 40 foot-pounds.

8. Check connecting rod end play on crankpin by tapping the two rods apart at crankpin and checking with feeler gage. Endplay should be at least .011" but not more than .021".

9. Install oil pick-up tube and strainer assembly on cylinder block, using new O-ring. Tighten screws and nut to 18 foot-pounds.

10. Install oil pan as described in Note 124b.

11. Install cylinder heads as described in Note 121b.

12. If working on Eldorado, install engine in vehicle chassis as described in Note 110b.

134. Connecting Rod Bearing Clearance Checking and Replacement

Worn bearings can be replaced without removing the rod and piston assembly by removing the cap and replacing the upper and lower halves. The clearance between the connecting rod bearing and the crankshaft can be measured with the aid of plastic gauging material, as follows:

1. Remove bearing cap and wipe oil from crankshaft journal and bearing insert.

2. With crankpin at approximate bottom dead center, place a piece of plastic gauging material in center of cap.

(NOTE: When using plastic gauging material, plastic material and part being measured must both be at room

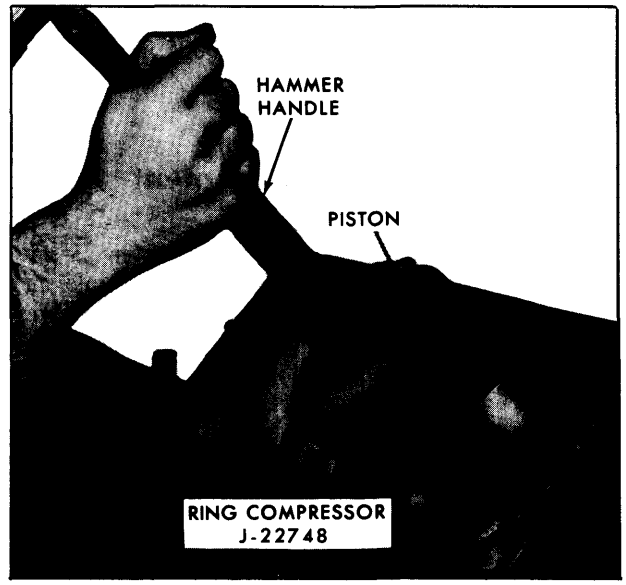


Fig. 6-212 Installing Piston in Cylinder Block

BACK TO INDEX

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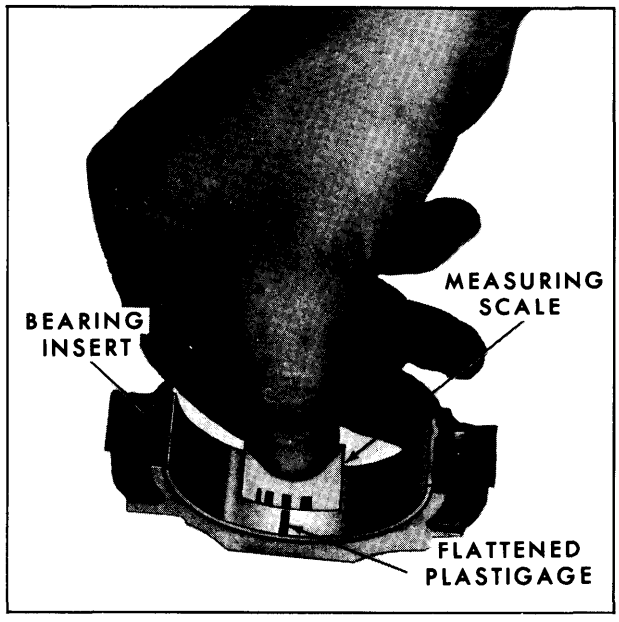


Fig. 6-213 Checking Bearing Clearance

temperature. If parts are excessively warm, an incorrect reading may result. Fresh plastic gauging material is recommended for greatest accuracy.)

3. Reinstall bearing cap. Tighten screws to 40 foot-pounds.

(NOTE: It is extremely important to position tangs on bearings in notches in rod and cap.)

4. Remove bearing cap and determine clearance by comparing width of flattened plastic gauging material, at its widest point, with graduations on plastic gauging material container. Number within matching graduation on envelope indicates clearance in thousandths of an inch. Fig. 6-213.

If clearance is greater than .0035 inch, replace bearing. If new bearings do not reduce clearance to less than .0035 inch, crankshaft must be replaced to obtain specified limits. If both new bearings and new crankshaft are installed, clearance should be from .0005 inch to .0028 inch.

135. Piston Ring Replacement

Each piston has two compression rings and a side-seal type oil ring that incorporates a steel expander and two identical chrome plated steel rails. The top compression ring is molybdenum filled cast iron. The second compression ring is coated cast iron.

When replacing piston rings, install only re-ring sets that have molybdenum filler upper compression ring, and multi-piece oil rings.

The compression rings are chamfered on the lower inner face. There is a locating "dimple" on both rings near the end for easy identification on the top side. Install with top side "dimple" facing up.

1. Place ring in area of cylinder where piston ring will travel. Be sure ring is square with cylinder bore by positioning ring with piston head.

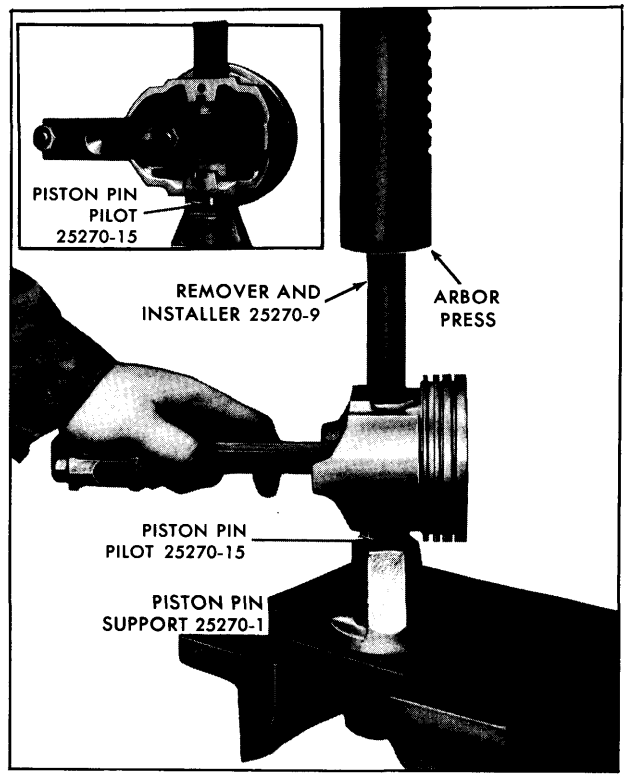


Fig. 6-214 Piston Pin Removal

2. Gap between compression ring ends should be .013 inch to .025 inch.

3. Gap between oil ring ends should be .015 inch to .055 inch.

4. With compression ring on piston, clearance between top surface of piston ring and ring land should be no greater than .005 inch. If clearance is greater, replace the ring. If the new ring does not reduce the clearance to .005 inch or less, new pistons should also be installed.

Clearance on new rings and new pistons should be .0017 inch to .0040 inch. This can be checked with a .0015 inch and .005 inch feeler gage on a "go-no-go" basis. The .0015 inch feeler gage should always enter; the .005 inch feeler gage should never enter. When installing rings on piston, gaps in piston rings should be staggered by approximately 120°.

136. Piston Pin

a. Removal

1. Place Piston Pin Support, J-25270-1, on arbor press and position Support Adapter J-25270-2 on support.

2. Insert Piston Pin Pilot, J-8390-9 in piston pin on side opposite letter "R" on piston.

3. Position piston and connecting rod assembly on support adapter with side of piston marked with the letter "R" upward, Fig. 6-214.

4. Using Piston Pin Remover and Installer,

BACK TO INDEX

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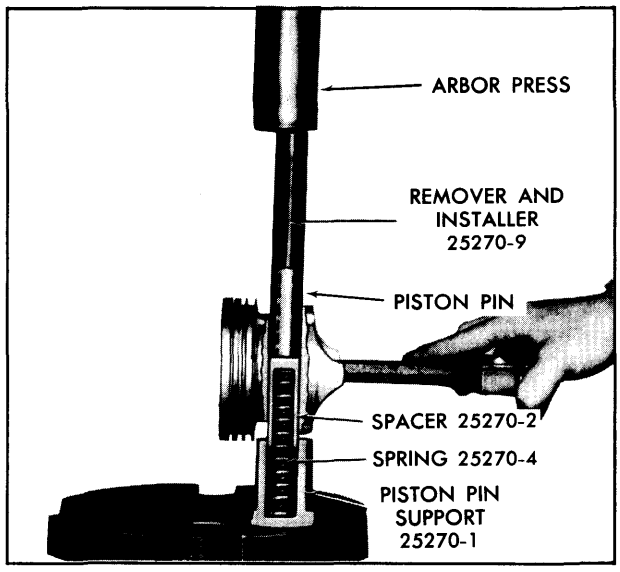


Fig. 6-215 Piston Pin Installation

J-25270-9, press pin out of piston and rod assembly.

5. Remove assembly from press and remove piston from support.

(NOTE: Keep piston pins in order so that they can be installed in the piston from which they were removed.)

b. Installation

1. Lubricate piston pin and pin holes in piston with engine oil to facilitate installation.

2. Place Piston Pin Support, J-25270-1 and Arbor J-25270-2, on arbor press with Spring and Spacer, J-25270-15, with (open end over spring in position in Support), Fig. 6-215.

3. Position connecting rod in its respective piston so that, when assembly is installed in engine, side of piston stamped with the letter "R" is toward rear of the engine and number on lower end of rod is down (Numbers 1, 3, 5, and 7 are in the right bank and 2, 4, 6, and 8 are in the left bank).

4. Position piston with connecting rod on Piston Pin Support, and insert piston pin into position as shown in Fig. 6-215.

5. Place Piston Pin Remover and Installer, J-25270-9, on piston pin and press pin until it bottoms on spacer in support. Remove piston and connecting rod from support. Center pin in piston, this will properly locate the connecting rod on the piston pin and piston.

(NOTE: Piston pins are a selective fit to the piston and are not available separately. Piston pins will not normally wear enough to cause a knock or tapping; however in cases where wear is abnormal, a new piston and pin assembly should be installed.)

137. Piston Clearance

When measuring piston diameter, the micrometer should be placed 3/16 inch below the cross slot or 1/4 inch below the oil ring grove, Fig. 6-216. Cylinders must be measured by placing the micrometer 1-1/8 inches from the top, and perpendicular to the centerline of the face.

An identification letter is stamped on the cylinder head face of the cylinder block. The letter is located directly below the cylinder bore. This letter denotes the cylinder-piston size as shown in the following table:

Letter	Cylinder Size (Diameter in Inches)	Piston Size (Diameter in Inches)
A	4.3000 - 4.3002	4.2992 - 4.2994
B	4.3002 - 4.3004	4.2994 - 4.2996
C	4.3004 - 4.3006	4.2996 - 4.2998
D	4.3006 - 4.3008	4.2998 - 4.3000
E	4.3008 - 4.3010	4.3000 - 4.3002
H	4.3010 - 4.3012	4.3002 - 4.3004
J	4.3012 - 4.3014	4.3004 - 4.3006
K	4.3014 - 4.3016	4.3006 - 4.3008
L	4.3016 - 4.3018	4.3008 - 4.3010
M	4.3018 - 4.3020	4.3010 - 4.3012

The table indicates ten piston sizes ranging in steps of .0002 inch from 4.2992 inches to 4.3012 inches. This makes it possible to maintain the .0006 to .0010 inch piston to cylinder wall clearance. The sizes shown apply at 70°F.

If double letters (such as AA, BB) appear on the cylinder head face of the block just above the cylinder bore, it indicates that this particular cylinder has been bored to .010 inch over the diameter indicated by a single letter in the chart. For example, a cylinder with the letters CC stamped on the block would have a diameter of 4.3104 inches to 4.3106 inches; a matching piston for this size would have a diameter of 4.3096 inches to 4.3098.

Orders for service pistons will be filled in sizes C, E, J, or L and HH, JJ, or KK through the servicing parts warehouses.

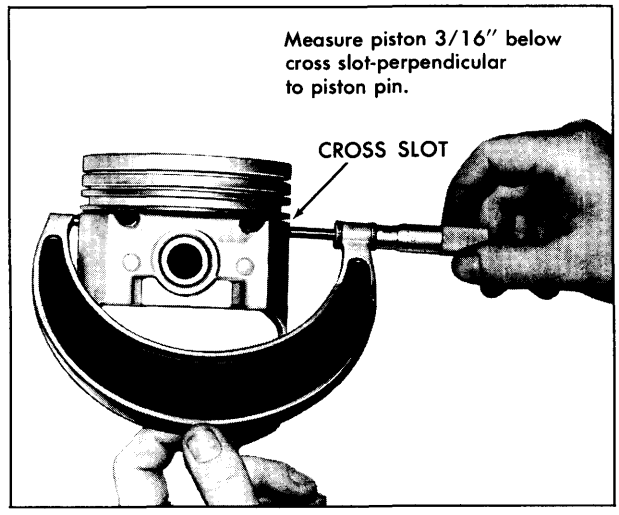


Fig. 6-216 Measuring Piston Diameter

BACK TO INDEX

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Cylinder bores must not be reconditioned to more than .0100 inch oversize as pistons are not available over this range.

While the current model is in production, specific code size pistons A through M and AA through MM are available from the factory Parts Warehouse in Detroit on a special order basis.

(NOTE: Before special ordering specific code size pistons, it is very important to check the sizes of the cylinder bores by actual measurement. Actual measurement at the time of replacement is the only certain way to avoid error in ordering.)

An outside micrometer and an inside micrometer are required to determine piston clearance. The outside micrometer, used for measuring piston diameter, must be adjusted to turn freely so that it can be adjusted up to the piston with a very light turning effort on the screw. If it is adjusted to get a frictional feel over the piston, it will show several tenths of a thousandth smaller than its actual size. With practice, fractional thousandths can be checked accurately.

The inside micrometer for measuring the cylinders may be used with or without an extension handle. It should be adjusted so the screw turns sufficiently tight to retain its setting while checking the cylinder at the different points to be measured.

The direct readings shown on the inside micrometer should not be taken as the cylinder sizes. With one end of the micrometer contacting the cylinder wall and the other being oscillated, adjust the micrometer until it will just slip through the cylinder with a light drag. Remove the micrometer, obtaining the same feel as when measuring the piston.

By this method, even if the two micrometers do not agree in readings, no error will result in arriving at the actual clearance of the piston in the cylinder.

138. Connecting Rod Alignment

Connecting rods are carefully aligned at the factory and it is not necessary to check their alignment in the field. Only in cases of damage will they become misaligned. If this condition does exist, the piston, pin, and rod assembly should be replaced. Do not attempt to straighten connecting rods.

139. Main Bearing Replacement and Clearance Checking

Shell type main bearings of steel-backed aluminum and steel-backed babbitt are used in all engines. Proper location for these bearings is shown in Fig. 6-217. No. 1 upper and lower bearings halves are interchangeable. No. 2 and 4 upper bearing halves are interchangeable. No. 2 and 4 lower bearing halves are interchangeable. No. 3 upper and lower bearing halves are not interchangeable. The crankshaft end thrust is taken by the center main bearing. The worn limit for crankshaft end play is .015 inch.

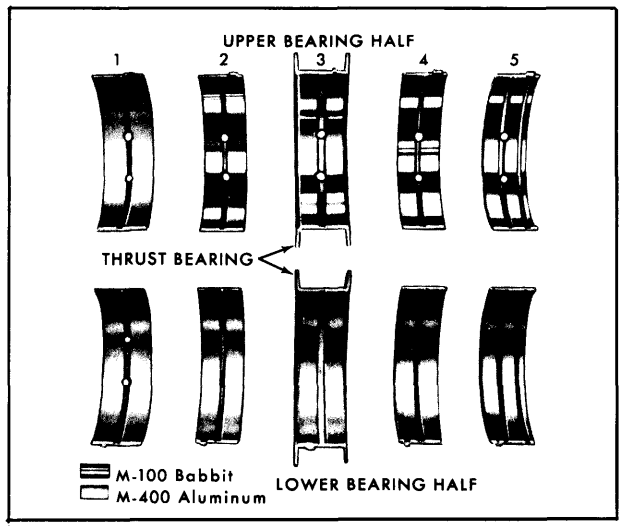


Fig. 6-217 Main Bearing Location

a. To Check a Main Bearing

1. Remove bearing cap to be checked.
2. Measure bearing wear using the plastic gauging material method as described in Note 134. Bearing cap must be tightened to 90 foot-pounds.

(NOTE: If bearings are being measured with engine in chassis, crankshaft must be supported in order to take up clearance between upper bearing shell and crankshaft. This can be done by removing bearing caps adjacent to bearing being checked, and placing a strip of .005 inch brass shim stock between lower bearing shell and crankshaft bearing journal.)

CAUTION: When reinstalling bearing caps with shims lightly tighten attaching screws to avoid damaging bearing caps.

3. If bearing clearance is greater than .0045 inch, replace bearing.
4. If new bearings do not reduce the clearance to less than .0045 inch, crankshaft should be replaced.

If both new bearings and new crankshaft are installed, clearance should be .0003 inch to .0026 inch for all bearings except front bearing. Clearance for front bearing should be .0001 inch to .0024 inch.

b. Main Bearing Replacement

1. If working on Eldorado, remove engine from vehicle chassis as described in Note 110a.
2. Remove spark plugs.
3. Remove engine oil pan as described in Note 124a.
4. Remove two cap screws and nut that hold oil intake screen assembly to cylinder block and remove screen assembly. Discard O-ring.
5. Remove two screws that hold bearing cap to cylinder block and remove cap. Remove worn shell from cap and discard.

(NOTE: Each bearing cap has a number of dimples (1, 2, 3, 4) machined on the bottom starting from the

BACK TO INDEX

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front of the engine, as shown in Fig. 6-209. Do not mismatch these caps or turn them around because they are individually matched when the cylinder block is machined.)

6. Install Upper Bearing Shell Remover, J-8080, into oil hole in crankshaft bearing journal, Fig. 6-218.

7. Slowly rotate crankshaft clockwise (viewed from front of engine) until tool contacts and forces out upper shell.

8. Install new upper shell in place as far as possible by hand, with locating tang in correct position. Remover Tool, J-8080, may also be used to aid in installing new upper shell. Install tool in crankshaft oil passage so that tool bears against notched end of bearing shell. Rotate crankshaft counterclockwise to position bearing, then remove tool, Fig. 6-218.

9. Install new lower shell in cap with locating tang in correct position.

(NOTE: When replacing the rear main bearing, use a new oil seal as described in Note 126).

10. Install cap on cylinder block and secure with two attaching screws. Tighten screws to 90 foot-pounds.

11. Replace four remaining bearings in same manner.

(NOTE: When replacing center bearing it is necessary to line up bearing thrust surfaces. To do this, install bearing cap screws finger tight. Then, using a plastic hammer, tap crankshaft fore and aft the limit of its travel several times. Do not use hammer on connecting rods, tap on counterweights only.)

12. Install oil intake screen assembly on cylinder block using new O-ring, and secure with attaching screws and nut. Tighten to 18 foot-pounds.

13. Install oil pan as described in Note 124b.

14. Install spark plugs and tighten to 25 foot-pounds. Connect spark plug wires at plugs.

15. If working on Eldorado, install engine in vehicle chassis as described in Note 110b.

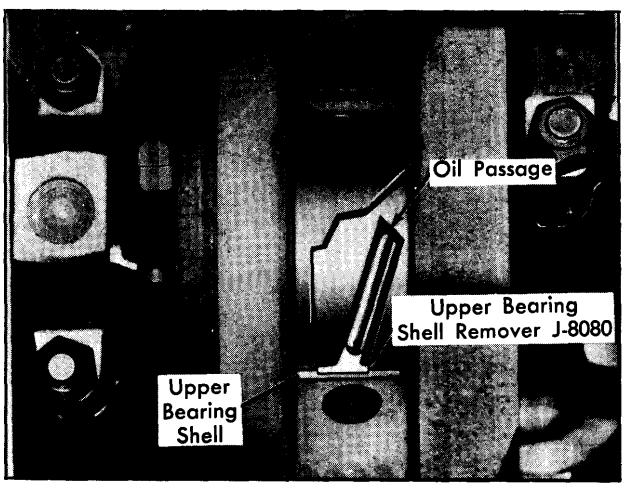


Fig. 6-218 Removing Upper Bearing Shell

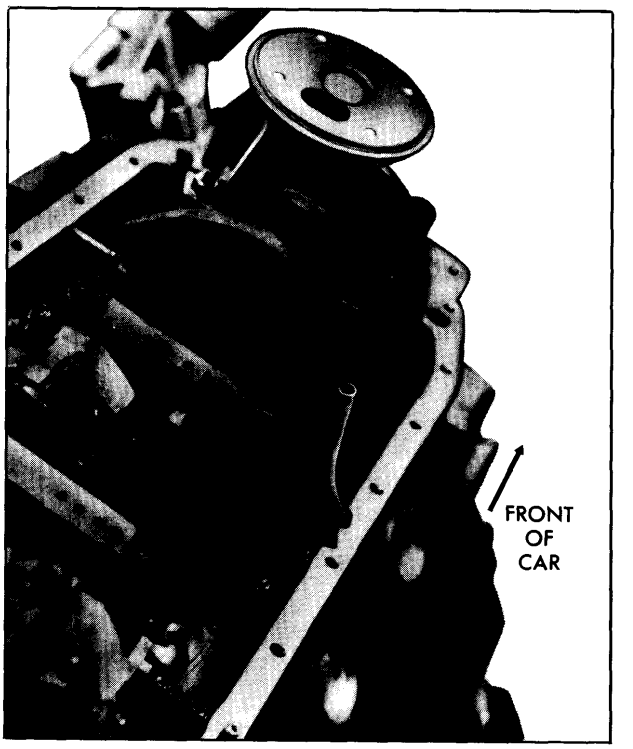


Fig. 6-219 Dipstick Tube Position—Except Eldorado

140. Dipstick Tube Installation

When replacing engine block and pistons, it is necessary to fit the new assembly with a replacement dipstick tube. To avoid interference with moving parts and to assure proper reading on dipstick when installed, heed the following instructions:

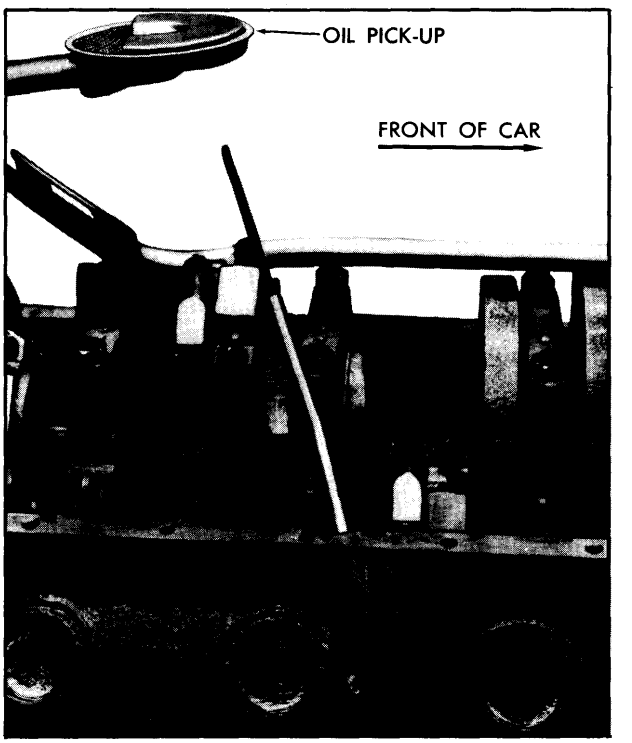


Fig. 6-220 Dipstick Tube Position—Eldorado

BACK TO INDEX

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1. Observe dipstick tube holes in left side of engine block. On all cars except the Eldorado, forward hole is for dipstick tube and rear hole should be blocked by a sealing ball. On the Eldorado the reverse is true (i.e., forward hole is blocked, leaving rear hole for tube installation).

2. Line up tube and tap in gently with hammer and block of wood until stop ring on tube contacts block.

3. Install 3/8" tubing bender on dipstick tube:

a. On all cars except the Eldorado, bend tube down and alightly rearward as shown in Fig. 6-219 (another view is given in Fig. 6-218).

b. On the Eldorado, put a shallow rearward bend in the tube so that tube misses No. 3 main bearing cap by 1/2". Tube should point to a spot just forward of center of oil pick up strainer, Fig. 6-220.

BACK TO INDEX

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SPECIFICATIONS

Items	All Series Unless Otherwise Noted
Bore	4.300"
Stroke	4.304"
Piston Displacement	500 cu. in.
Compression Ratio	8.50 to 1
Compression Pressure	
At cranking speed (throttle open)	145-165 psi
Points of Suspension	3
VALVES	**Intake / Exhaust**
Clearance between stem and guide New limits	.0010"-.0027"
Worn limits, not over	.005"
Clearance between lifter body and crankcase	.0005"-.0020"
Head diameter, overall	.000" / 1.625"
Lift	.457" / .473"
Valve face angle	44°
Valve seat angle (in head)	45°
Seat width (in head)	1/16"
Seat eccentricity, not over (T.I.R.)	.004"
Stem diameter	.3413"-.3420"
Valve guide diameter (in head)	.343"
Rocker Arm Ratio	1.72:1
VALVE SPRINGS	
Free Length	2.250"
Pounds required to compress to 1.946" (Valve closed)	60 - 65
Pounds required to compress to 1.496" (Valve open)	155 - 165
CAMSHAFT	
Chain	
Type	Silent Chain
Adjustment	None
Length	.24"
Number of links	.48
Pitch	.500"
Width	.750"
Bearing Clearance	
Number	5
New limits	.001"-.0022"
Worn limits, not over	.004"
Out-of-round, not over	.002"
Valve Timing (with ramp at .001" lift)	
Intake opens	21° B.T.D.C.
Intake closes	111° A.B.D.C.
Exhaust opens	73° B.B.D.C.
Exhaust closes	55° A.T.D.C.
Valve Lift	
Intake	.457"
Exhaust	.473"
Duration	
Intake	312°
Exhaust	308°
Valve Overlap	76°
CONNECTING RODS	
Bearing Material	Aluminum
Clearance between bearing and shaft --	
New limits	.0005" - .0028"
Worn limits, not over	.0035"
Diameter lower end, without bearing	2.6243" - 2.6250"
Length, center to center	6.75"
End play of rods on crank pin	.008" - .020"
PISTON RINGS	
Clearance between rings and sides of groove in piston --	
Compression rings	.0017" - .0040"
Oil rings	.NONE - Side Sealing
Gap between ends	
Compression rings	.013" - .025"
Oil rings	.015" - .055"
Number of compression rings	2
Number of oil rings	1
Width of compression ring groove	.0802" - .0810"
Width of oil ring groove	.188" - .189"
Diameter at bottom of groove	
Oil ring	3.880" - 3.874"
Compression rings	3.843" - 3.849"
PISTON PINS	
Clearance between pin and piston --	
New limits	.0002" - .0004"
Pin length	3.030"
Pin diameter	.9994" - .9999"
PISTONS AND CYLINDERS	
Cylinder bore out-of-round (new or reground limit) Not over	.0005"
Piston Taper, not over	.0005" - .002"
Piston Material	Aluminum Alloy
Piston skirt top clearance	.0006" - .0010"
Piston skirt bottom clearance	-.0014" - +.0005"

Cylinder and piston sizes (as indicated by letters stamped on the cylinder head gasket surface). The letters are in groups of two for adjacent cylinders (such as "H" and "B") midway between the two cylinders. The letters denote the cylinder piston sizes as shown on page 6-53.

BACK TO INDEX

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SPECIFICATIONS (Cont'd.)

Items	All Series Unless Otherwise Noted

Letter	Cylinder Size (Diameter in Inches)	Piston Size (Diameter in Inches)
A	4.3000 - 4.3002	4.2992 - 4.2994
B	4.3002 - 4.3004	4.2994 - 4.2996
C	4.3004 - 4.3006	4.2996 - 4.2998
D	4.3006 - 4.3008	4.2998 - 4.3000
E	4.3008 - 4.3010	4.3000 - 4.3002
H	4.3010 - 4.3012	4.3002 - 4.3004
J	4.3012 - 4.3014	4.3004 - 4.3006
K	4.3014 - 4.3016	4.3006 - 4.3008
L	4.3016 - 4.3018	4.3008 - 4.3010
M	4.3018 - 4.3020	4.3010 - 4.3012

OIL PUMP

Oil pump type	Spur Gear
Backlash between drive gears	.001" - .013"
Clearance between pump body and gears --	
New limits	.001" - .004"
Worn limits, not over	.005"
No. of teeth on each gear	9

CRANKSHAFT AND MAIN BEARINGS

Clearance, main bearings --	
New limits	.0001" - .0026"
Worn limits, not over	.0045"
Main bearing caps --	
Screw thread diameter	1/2"
Main bearing journal, diameter	3.250"
Main bearing journals, out-of-round not over	.00025"
Main bearing journal length --	
No. 1 and No. 5	1.1925"
No. 2 and No. 4	1.0595"
No. 3	1.0670"
Main bearings material	AT-20 Aluminum and M-100 Babbitt
Crankpin diameter	2.500"
Crankpin out-of-round not over	.00025"
End play in crankshaft --	
New limits	.002" - .012"
Worn limits	.015"

OIL PRESSURE REGULATOR

Clearance between valve plunger and housing --	
New limits	.0020" - .0035"
Worn limits, not over	.005"
Normal pressure at 30 mph	
Minimum	35 psi
Idle (average)	10 psi
Spring	
Free length	2.57" - 2.69"
Lbs. required to compress to 1.460 inches	9.3 - 10.5
Valve opens at	35 - 40 psi

BACK TO INDEX

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TORQUE SPECIFICATIONS

Material No.	Application	Thread Size	Torque
280-M	Camshaft Sprocket to Camshaft Screws	5/16-18	18 ft. lbs.
260-M	Carburetor to Intake Manifold Screw (Front)	5/16-18	11 ft. lbs.
280-M	Carburetor to Intake Manifold Screw (Rear)	5/16-18	15 ft. lbs.
1038	Connecting Rod Nut	3/8-24	40 ft. lbs.
300-M	Cylinder Head to Cylinder Block Screw (All-Special) Oiled	1/2-13	115 ft. lbs.
Special	Cylinder Head Temperature Switch	3/8-24	6 ft. lbs.
286-M	Distributor Clamp Nut	5/16-24	15 ft. lbs.
286-M	Engine Front Support Mount to Cylinder Block Nut	3/8-24	21 ft. lbs.
286-M	Engine Front Support Mount Stud to Frame Nut	1/2-20	52 ft. lbs.
300-M	Engine Rear Support Mount to Rear Support Cross Member Bolt	3/8-16	45 ft. lbs.
280-M	Engine Rear Support Cross Member to Frame Bolt	5/16-18	20 ft. lbs.
280-M	Engine Rear Support Mount to Transmission Extension Housing Bolt	7/16-24	50 ft. lbs.
286-M	Eldorado Engine Front Mounting Support Bracket to Crankcase Nut	3/8-24	21 ft. lbs.
286-M	Eldorado Engine Front Support Cushion to Frame Nut	7/16-14	35 ft. lbs.
300-M	Eldorado Engine Front Support Cushion to Engine Mounting Bracket Nut	7/16-20	57 ft. lbs.
280-M	Eldorado Engine Rear Support Bracket to Transmission Bolt	7/16-14	50 ft. lbs.
280-M	Eldorado Engine Rear Support Assembly to Bracket	7/16-14	46 ft. lbs.
280-M	Eldorado Engine Rear Support Assembly to Frame (Bolt or Nut)	1/2-13	52 ft. lbs.
280-M	Exhaust Manifold to Cylinder Head Screw	3/8-16	35 ft. lbs.
260-M	Fan Blade Assembly Mounting Screw	15/16-24	18 ft. lbs.
280-M	Flywheel to Converter Housing Screw	3/8-16	30 ft. lbs.
280-M	Flywheel to Crankshaft Screw (All)	7/16-20	75 ft. lbs.
280-M	*Front Cover to Cylinder Block Screw	5/16-18	10 ft. lbs.
280-M	*Front Cover to Cylinder Block Screw	3/8-16	22 ft. lbs.
280-M	Fuel Pump to Engine Screw	5/16-18	12 ft. lbs.
286-M	Fuel Pump to Engine Nut	5/16-14	12 ft. lbs.
280-M	Fuel Pump Eccentric	3/8-16	35 ft. lbs.
260-M	Generator Adjusting Link to Generator Screw	5/16-18	10 ft. lbs.
260-M	Generator Support Bracket Screw	3/8-16	17 ft. lbs.
1112	Generator Support Bracket Nut	3/8-24	17 ft. lbs.
1010	Heater Hose Clamps	10-24	14 ft. lbs.
260-M	Ignition Coil Mounting Screw	5/16-18	15 ft. lbs.
280-M	Intake Manifold to Cylinder Head Screw	3/8-16	30 ft. lbs.
300-M	Main Bearing Cap to Cylinder Block Screw	1/2-13	90 ft. lbs.
Special	Oil Pan Drain Plug	1/2-20	25 ft. lbs.
1010	Oil Pan to Cylinder Block Nut	5/16-24	10 ft. lbs.
1010	Oil Pan to Cylinder Block Screw	5/16-18	10 ft. lbs.
280-M	Oil Pick-up and Strainer to Cylinder Block Screw	5/16-18	15 ft. lbs.
286-M	Oil Pick-up Tube and Strainer Assembly to Main Bearing Bolt	3/8-24	35 ft. lbs.
Special	Oil Pressure Switch	1/4" Pipe	20 ft. lbs.
280-M	Oil Pump Assembly to Engine Screw	5/16-18	15 ft. lbs.
280-M	Pulley to Harmonic Balancer Screw	5/16-18	17 ft. lbs.
1010-M	**Rocker Arm Cover to Cylinder Head Screw/Washer	1/4-20	30 in. lbs.
300-M	Rocker Arm Support Bolt	7/16-14	70 ft. lbs.
1018	Starter Motor Brace Mounting Screw	5/16-18	12 ft. lbs.
1018	Starter Motor Brace Mounting Nut	1/4-20	70 in. lbs.
280-M	Starter Motor Mounting Screws	3/8-16	45 ft. lbs.
Special	Spark Plug	14mm	25 ft. lbs.

BACK TO INDEX

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TORQUE SPECIFICATIONS (Cont'd.)

Material No.	Application	Thread Size	Torque
Special	Temperature Indicator Switch	1/2" Pipe	40 ft. lbs.
260-M	Thermostat Housing to Engine Screw	5/16-18	10 ft. lbs.
280-M	Transmission Housing to Cylinder Block	3/8-16	35 ft. lbs.
260-M	*Water Pump to Front Cover Screw	1/4-20	70 in. lbs.
280-M	*Water Pump to Cylinder Block Screw	5/16-18	10 ft. lbs.
280-M	*Water Pump to Cylinder Block Screw	3/8-16	22 ft. lbs.

*Refer to Fig. 6-147 for proper location.
**Retorque rocker arm covers after engine has been run.

(NOTE: Refer to back of manual, Page 16-1, for bolt and nut markings and steel classifications.)

BACK TO INDEX

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SPECIAL TOOLS

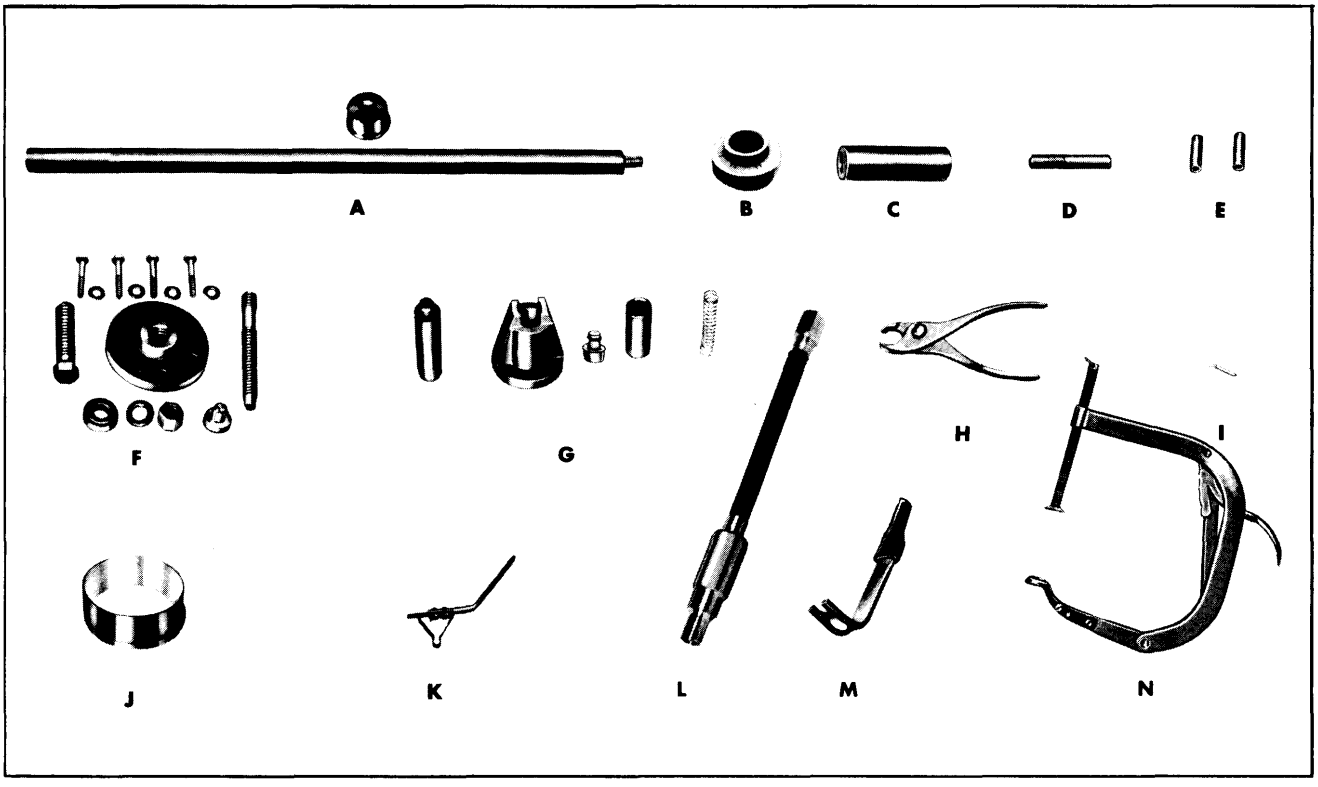


Fig. 6-222 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-25262	Camshaft Bearing Remover and Installer Set	G	J-25270-90	Piston Pin Remover and Installer Set
B	J-22770	Front Cover Oil Seal Installer	H	J-3049	Valve Lifter Remover
C	J-4160	Hydraulic Valve Lifter Plunger Remover	I	J-8080	Main Bearing Upper Shell Remover
			J	J-22748	Piston Ring Compressor
D	J-2730	Valve Lifter Lock Ring Installer	K	J-3074	Valve Lifter Leak-Down Tester
E	J-3224	Connecting Rod Bolt Guide Set	L	J-22794	Adapter
F	J-21052	Harmonic Balancer Remover and Installer Set	M	J-22765	Valve Spring Compressor
			N	J-8062	Valve Spring Compressor

BACK TO INDEX

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THEORY OF OPERATION

(NOTE: For service information pertaining to the Eldorado transmission refer to the latter portion of this section, Page 7-69.)

The same Turbo Hydra-matic automatic transmission, Fig. 7-1, is used on all Cadillac rear wheel drive cars and is identified by the letters AA Carburetor Engine & AB for EFI that appear in the upper corners of the name plate, Fig. 0-2.

The 1976 transmission is similar to 1973. Refer to the 1973 Shop Manual for information pertaining to Theory of Operation, Hydraulic System Description, Valve and Hydraulic Control Functions and Oil Circuit Diagrams.

DIAGNOSIS

Turbo Hydra-Matic 400 Diagnosis Procedure

(NOTE: The following information, unless specifically noted elsewhere, is applicable to the Eldorado. See Page 7-69.)

CAUTION: In the event of a major transmission malfunction, replace filter assembly, flush oil cooler and lines before installing new fluid. This is particularly important in the case of a converter or pump malfunction.

This Diagnosis Guide should be used in the following sequence to positively locate the problem:

1. Perform the "Preliminary Checking Procedure" on page 7-4, recording the readings in the Oil Pressure Reading row. After taking the pressure readings, place Low, Normal or High in each box of the Oil Pressure Pattern row.
2. Road test the car as described in Part B if problem is not known.
3. Refer to the "Transmission Malfunction Related to Oil Pressure" chart on page 7-6. First, determine if malfunction noted is in this chart. If so, compare Oil Pressure Pattern row on page 7-4 and page 7-6. A dash on the "Transmission Malfunction Related to Oil Pressure" chart means that the oil pressure reading has no significance under the test condition.

If transmission malfunction is found in this chart, follow the directions indicated in the Malfunction column. The oil pressure pattern will indicate where the malfunction is.

The only time it is necessary to determine a pressure drop (the control valve assembly-governor line pressure check, part b) is when there is "No 1-2 Upshift and/or Delayed Upshift" and all oil pressure readings are normal.

It will not be necessary to repeat oil pressure readings taken during preliminary checks should this be called for during further tests.

4. If malfunction cannot be determined by the chart on page 7-6, or if upon completion of these tests, it is not found, see the "Transmission Troubleshooting Guide", starting with Part C to locate malfunction not related to oil pressure.

All malfunctions, both those related to oil pressure and those that are not, are listed in the "Transmission Troubleshooting Guide". Always perform the "Preliminary Checking Procedure" first as it provides a positive means to isolate the problem if the malfunction can be diagnosed by this procedure.

5. After correcting malfunction, road test car as described in Part B Transmission Road Testing.

(NOTE: This information pertains to all Cadillac transmissions. For additional illustrations on the Eldorado transmission, see the later portion of this section.)

A. Preliminary Checking Procedure

Perform checking procedure shown on Part a.

B. Transmission Road Testing

1. Connect portable tachometer to engine. Engine rpm will identify shift points.
2. Place selector in "Drive Left" position and accelerate the vehicle from rest at a minimum throttle opening. The specifications for shift points are:

Upshift	Maximum
1-2	15 mph
2-3	30 mph

Accelerate the vehicle from rest at wide-open throttle. The specifications for shift points are:

Upshift	Maximum
1-2	44-48 mph
2-3	77-83 mph
Detent Downshifts	
3-2	68-73 mph
2-1	28-32 mph

Downshifts should occur (3-2 and 2-1) as the vehicle speed decreases to 0 mph. Stop car.

3. Place selector in "Drive Right" position and accelerate the vehicle from rest. A 1-2 shift should occur at all throttle openings. No 2-3 shift can be obtained in this range. Stop car.
4. Place selector in "Low". No upshift should occur in this range regardless of the throttle opening.
5. Position the selector in "Drive Left" and accelerate the vehicle to 35 mph and move the selector to "Drive Right". A 3-2 downshift should occur, increasing the engine rpm and an engine braking effect should be noticed on deceleration.
6. With the selector in "Drive Right" at approximately 25 mph, but not over 40 mph, at closed throttle, move the selector to "Low". A 2-1 downshift should occur, increasing the engine rpm and an engine braking effect should be noticed on deceleration. Stop car.
7. Place selector in "Reverse" and check for reverse operation.

BACK TO INDEX

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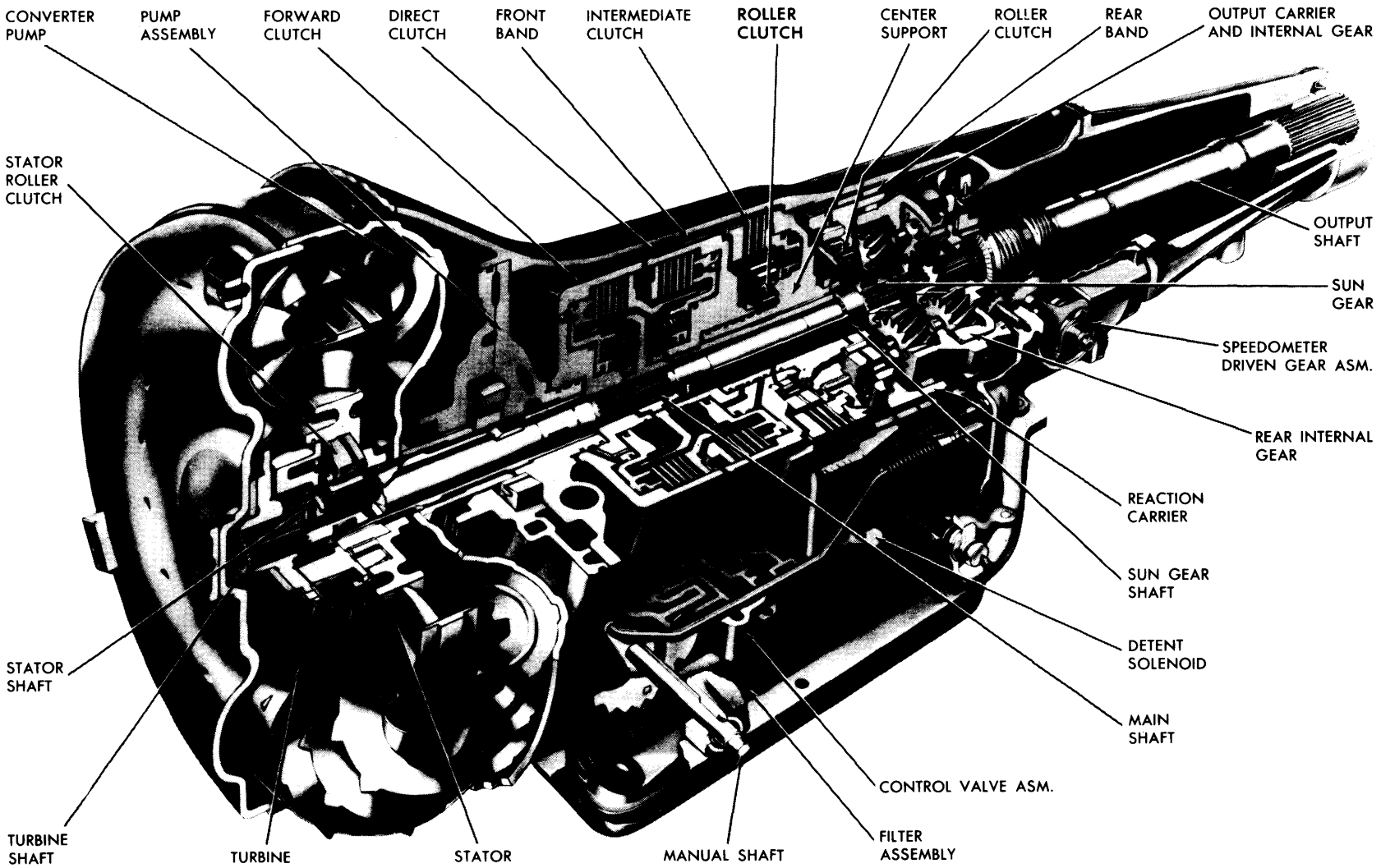
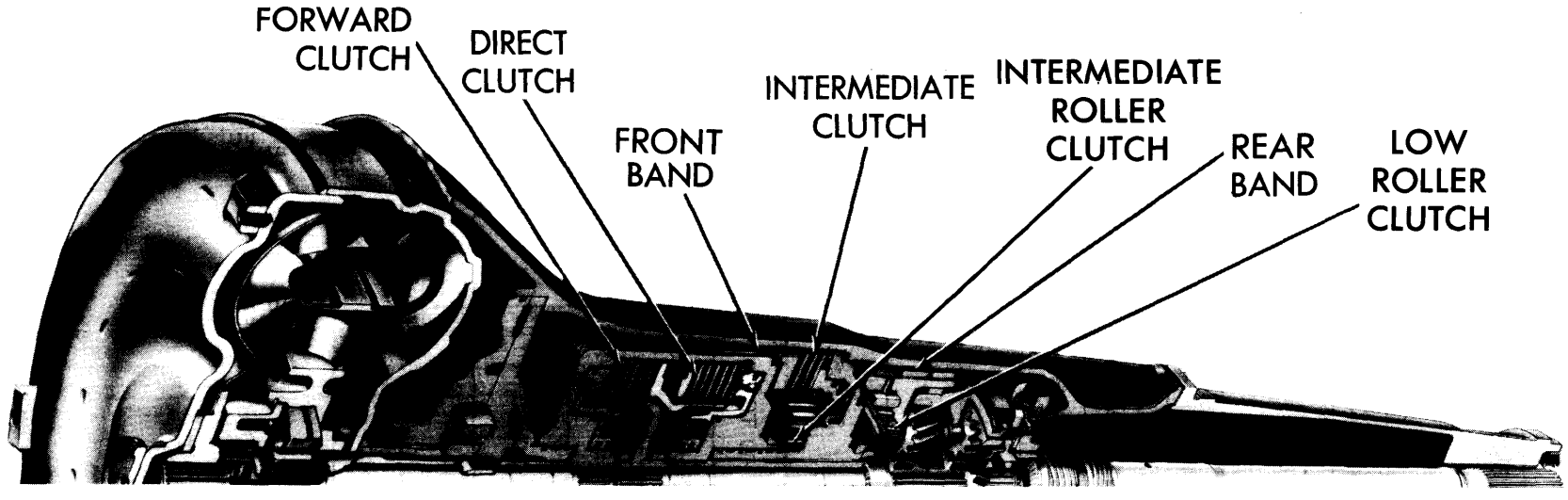


Fig. 7-1 Turbo Hydra-Matic Transmission—Cutaway View

BACK TO INDEX

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SELECTOR POSITION	PUMP PRESSURE	FORWARD CLUTCH	DIRECT CLUTCH	FRONT BAND	INT. CLUTCH	INT. ROLLER CLUTCH	LOW ROLLER CLUTCH	REAR BAND
PARK—NEUT.	60-150	OFF	OFF	OFF	OFF	OFF	OFF	OFF
DRIVE 1 LEFT 2 3	60-150 60-150 60-150	ON ON ON	OFF OFF ON	OFF OFF OFF	OFF ON ON	OFF ON OFF	ON OFF OFF	OFF OFF OFF
DRIVE 1 RIGHT 2	150 150	ON ON	OFF OFF	OFF ON	OFF ON	OFF ON	ON OFF	OFF OFF
LO 1 2	150 150	ON ON	OFF OFF	OFF ON	OFF ON	OFF ON	ON OFF	ON OFF
REV.	95-240	OFF	ON	OFF	OFF	OFF	OFF	ON

Fig. 7-2 Band, Roller Clutch and Clutch Application Chart

BACK TO INDEX

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DIAGNOSIS

PRELIMINARY CHECKING PROCEDURE

CHECK TRANS. OIL LEVEL (See Note 5)

CHECK OUTSIDE MANUAL LINKAGE AND CORRECT (See Note 3)

CHECK ENGINE TUNE

INSTALL OIL PRESSURE GAGE (See Fig. 7-3)

CONNECT TACHOMETER TO ENGINE

CAUTION: TOTAL RUNNING TIME FOR THIS COMBINATION NOT TO EXCEED 2 MINUTES.

CHECK OIL PRESSURES IN FOLLOWING MANNER

	RANGE	OIL PRESSURE READING	NORMAL P.S.I.	OIL PRESSURE PATTERN LOW—NORMAL—HIGH
1	NEUTRAL—BRAKES APPLIED ENGINE AT 1000 RPM		55 TO 70	
2	DRIVE IDLE SET ENGINE IDLE TO SPECIFICATIONS		60 TO 85	
3	DRIVE LEFT—BRAKES APPLIED ENGINE AT 1000 RPM		60 TO 90*	
4	DRIVE RIGHT OR LO—BRAKES APPLIED ENGINE AT 1000 RPM		135 TO 160*	
5	REVERSE—BRAKES APPLIED ENGINE AT 1000 RPM		95 TO 150*	
6	DRIVE LEFT—BRAKES APPLIED ENGINE AT 1000 RPM DOWNSHIFT SWITCH ACTIVATED		90 TO 110	
7	GOVERNOR CHECK—FOR UPSHIFT PROBLEM SEE PROCEDURE, NOTE 2		DROP OF 10 PSI OR MORE	
8	DRIVE — 30 MPH — CLOSED THROTTLE ON ROAD, OR ON HOIST**		55 TO 70	

* IF HIGH LINE PRESSURES ARE EXPERIENCED, SEE NOTE1.

** VEHICLE ON HOIST, DRIVING WHEELS OFF GROUND, SELECTOR IN DRIVE, BRAKES RELEASED, RAISE ENGINE TO 3000 R.P.M., CLOSE THROTTLE AND READ PRESSURE BETWEEN 2000 AND 1200 R.P.M.

BACK TO INDEX

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Diagnosis Secondary Check A: High Line Pressures

With Exhaust Gas Recirculation (EGR), the throttle is open enough in "Drive" range 1000 rpm to cause the EGR valve to open. When the EGR valve opens, exhaust gas enters the intake manifold which lowers intake manifold vacuum. When intake manifold vacuum is lowered, the transmission line oil pressure raises accordingly, and may go above the upper specification limit. For this reason, if high line pressures are obtained, proceed as follows:

1. Disconnect the EGR vacuum line at the EGR valve and plug the vacuum line.
2. Recheck line pressures as indicated on the Preliminary Checking Procedure Chart on page
3. If high line pressures are still obtained, continue below.

If High Line Pressures Were Obtained With The EGR Vaccum Line Plugged

If high line pressures are experienced with the EGR line plugged, it may be that the engine is not producing enough vacuum to lower transmission line pressure within specifications. The newer engines with emission controls characteristically have lower engine vacuum than older past model engines. To obtain line pressures suitable for evaluation, it is recommended that vacuum be applied to the modulator, using an external vacuum source such as J-23738 hand operated vacuum device or its equivalent. The unit allows definite amounts of vacuum to be applied to the modulator so that consistent line pressures may be obtained for evaluation as follows:

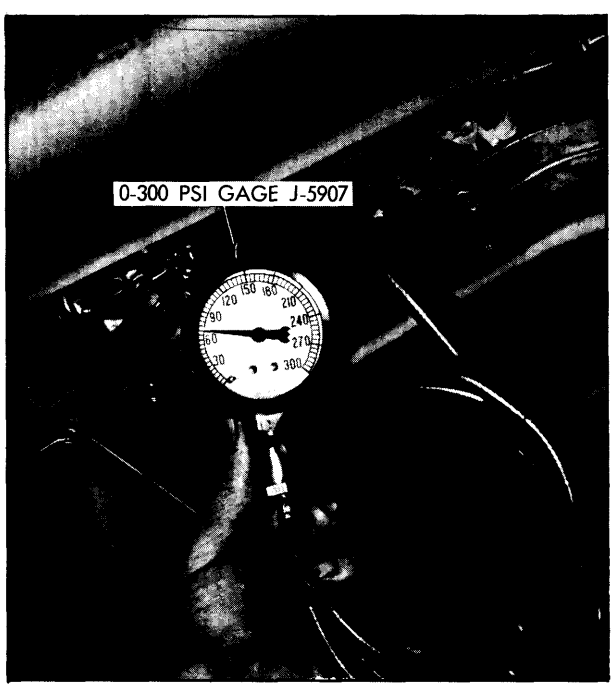


Fig. 7-3 Oil Pressure Test Gauge

1. Disconnect the vacuum hose to the modulator at the modulator and plug the vacuum hose.
2. Attach the hand operated vacuum device and apply 20" of vacuum.
3. Recheck line pressures according to the Preliminary Checking Procedure Chart, on page 7-4.
4. If line pressures are still high, proceed to the specific diagnosis chart that applies to the malfunction encountered.
5. If line pressures are normal with external vacuum applied, check engine vacuum and vacuum systems for leaks.

Diagnosis Secondary Check B: Control Valve Assembly — Governor Check

1. Install line pressure gage.
2. Install tachometer.
3. Disconnect vacuum line to modulator.
4. With vehicle on hoist (driving wheels off ground), foot off brake, in drive, check line pressure at 1000 rpm.
5. Slowly increase engine rpm to 3000 rpm and determine if a line pressure drop occurs (10 psi or more).
6. If pressure drop of 10 psi or more occurs, disassembly, clean and inspect control valve assembly.
7. If pressure drop is less than 10 psi:

a. Inspect governor
   1. Stuck valve
   2. Weight Freeness.
   3. Restricted orifice in governor valve.
   4. Check governor valve entry and exhaust (.020" min.). For procedure, refer to current service manual.

b. Governor feed system
   1. Check screen in control valve assembly or case.
   2. Check for restrictions in governor pipe.
   3. Check for fit of governor pipes in case holes.

BACK TO INDEX

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BACK TO INDEX

PRELIMINARY DIAGNOSIS CHART
TRANSMISSION MALFUNCTION RELATED TO OIL PRESSURE

(PRESSURES OBTAINED BY THE PRELIMINARY CHECKING PROCEDURE, PAGE 2)

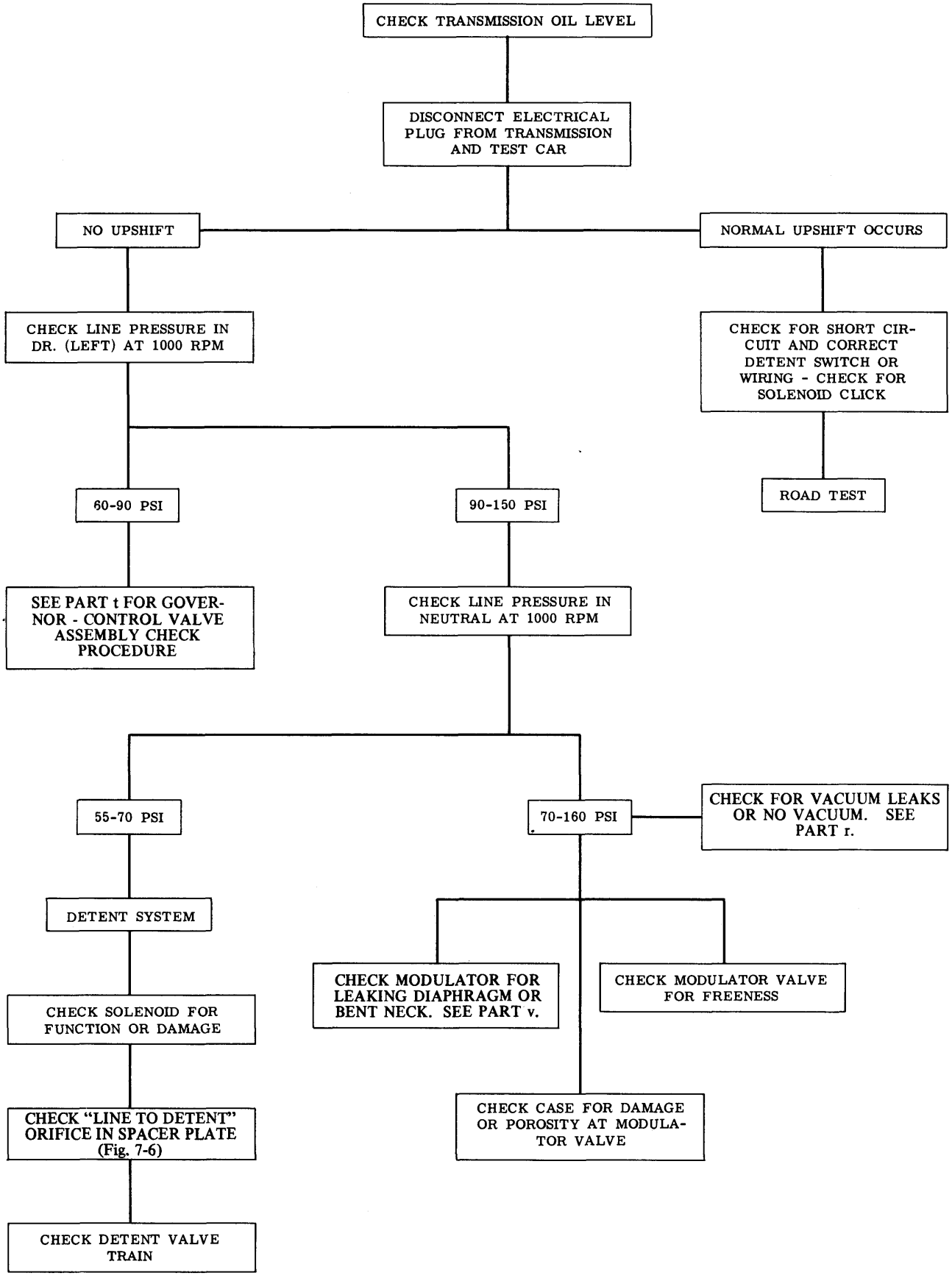
	1	2	3	4	5	6	7	8	
MALFUNCTION	NEUTRAL BRAKES APPLIED 1000 RPM	DRIVE IDLE	DRIVE LEFT— BRAKES APPLIED 1000 RPM	DRIVE—R BRAKES APPLIED 1000 RPM	REVERSE BRAKES APPLIED 1000 RPM	DRIVE LEFT— BRAKES APPLIED 1000 RPM DOWNSHIFT SWITCH ACTIVATED	PRESSURE DROP OCCURS WHILE ENGINE RPM INCREASES FROM 1000 TO 3000 RPM WHEELS FREE TO MOVE*	DRIVE 30 MPH CLOSED THROTTLE	POSSIBLE CAUSE OF MALFUNCTION
	OIL PRESSURE	OIL PRESSURE	OIL PRESSURE	OIL PRESSURE	OIL PRESSURE	OIL PRESSURE		OIL PRESSURE	
NO 1-2 UPSHIFT AND/OR DELAYED UPSHIFT	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	10 PSI DROP OR MORE	NORMAL	MALFUNCTION IN CONTROL VALVE ASSY.
	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	LESS THAN 10 PSI DROP	NORMAL	MALFUNCTION IN GOVERNOR OR GOVERNOR FEED SYSTEM
	NORMAL	HIGH	HIGH	NORMAL	NORMAL	NORMAL		HIGH	MALFUNCTION IN DETENT SYSTEM
	HIGH	HIGH	HIGH	NORMAL	HIGH	—	—	—	MALFUNCTION IN MODULATOR OR VACUUM FEED SYSTEM TO MODULATOR
SLIPPING—REVERSE	NORMAL	NORMAL	NORMAL	NORMAL	LOW	NORMAL		NORMAL	OIL LEAK IN FEED SYSTEM TO THE DIRECT CLUTCH
SLIPPING—1ST GEAR	NORMAL	LOW TO NORMAL	LOW TO NORMAL	LOW TO NORMAL	NORMAL	LOW TO NORMAL	—	LOW TO NORMAL	OIL LEAK IN FEED SYSTEM TO THE FORWARD CLUTCH
DOWNSHIFT WITH ZERO THROTTLE AND NO ENGINE BRAKING IN DRIVE	NORMAL	HIGH	NORMAL	NORMAL	NORMAL	—	—	HIGH	STATOR AND DETENT WIRES SWITCHED
NO DETENT DOWNSHIFTS	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	LOW		NORMAL	MALFUNCTION IN DETENT SYSTEM

* DRIVE RANGE, VACUUM LINE DISCONNECTED FROM MODULATOR.

NOTE: A DASH (—) IN THE ABOVE CHART MEANS THAT THE OIL PRESSURE READING HAS NO MEANING UNDER THE TEST CONDITION.

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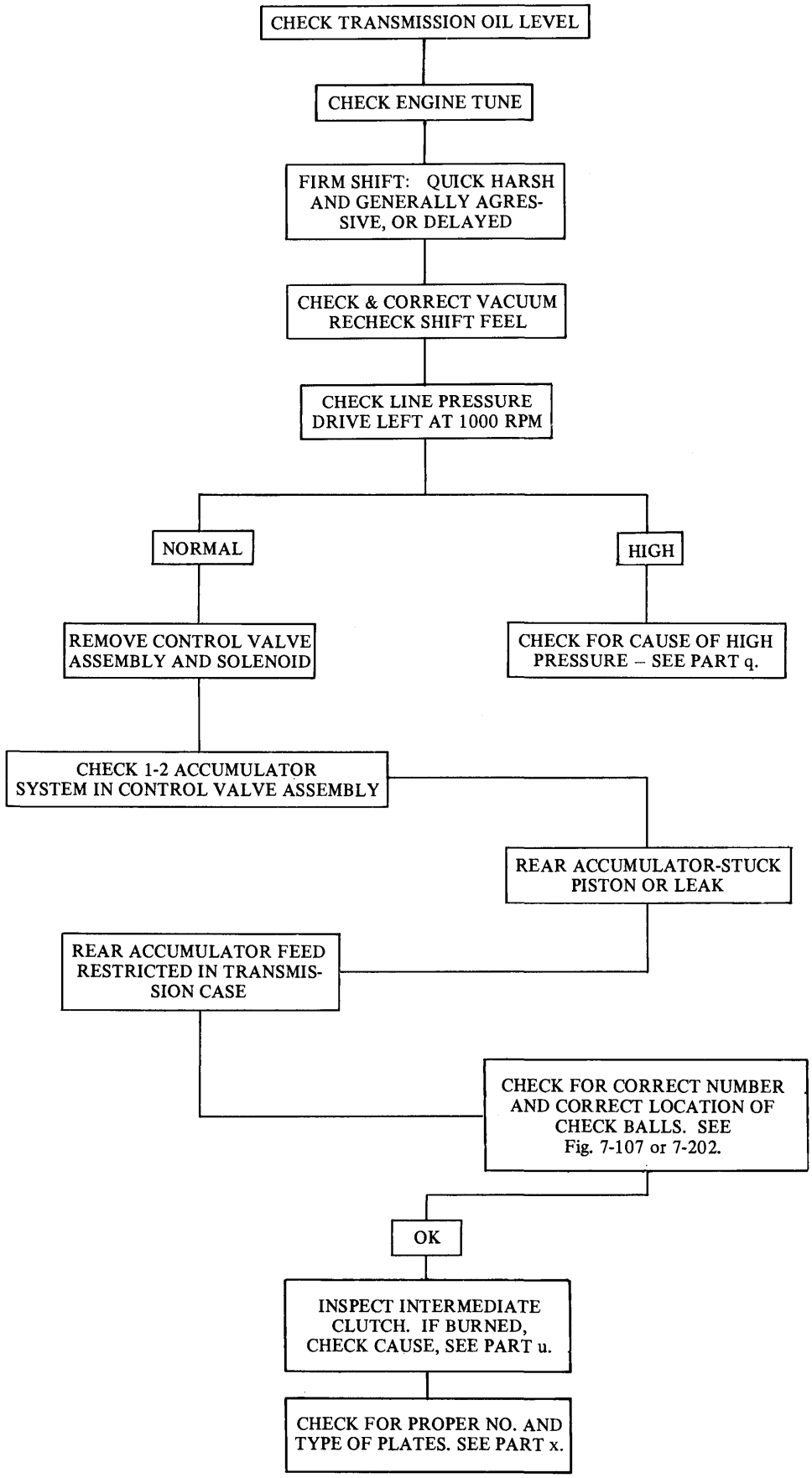
c. No. 1-2 Upshift and/or Delayed Upshift



BACK TO INDEX

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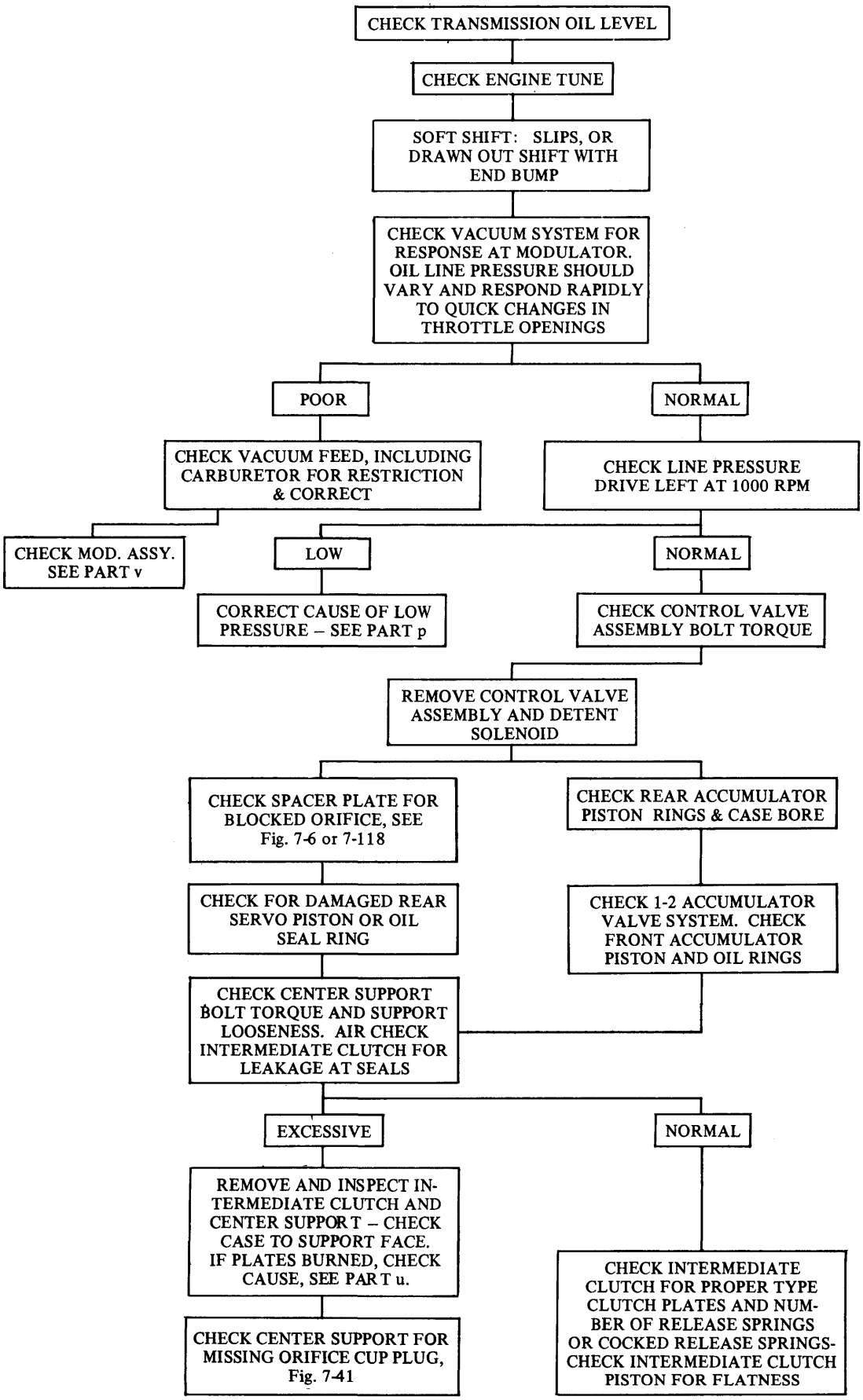
d. 1-2 Shift Feel Complaint—Firm Shift



BACK TO INDEX

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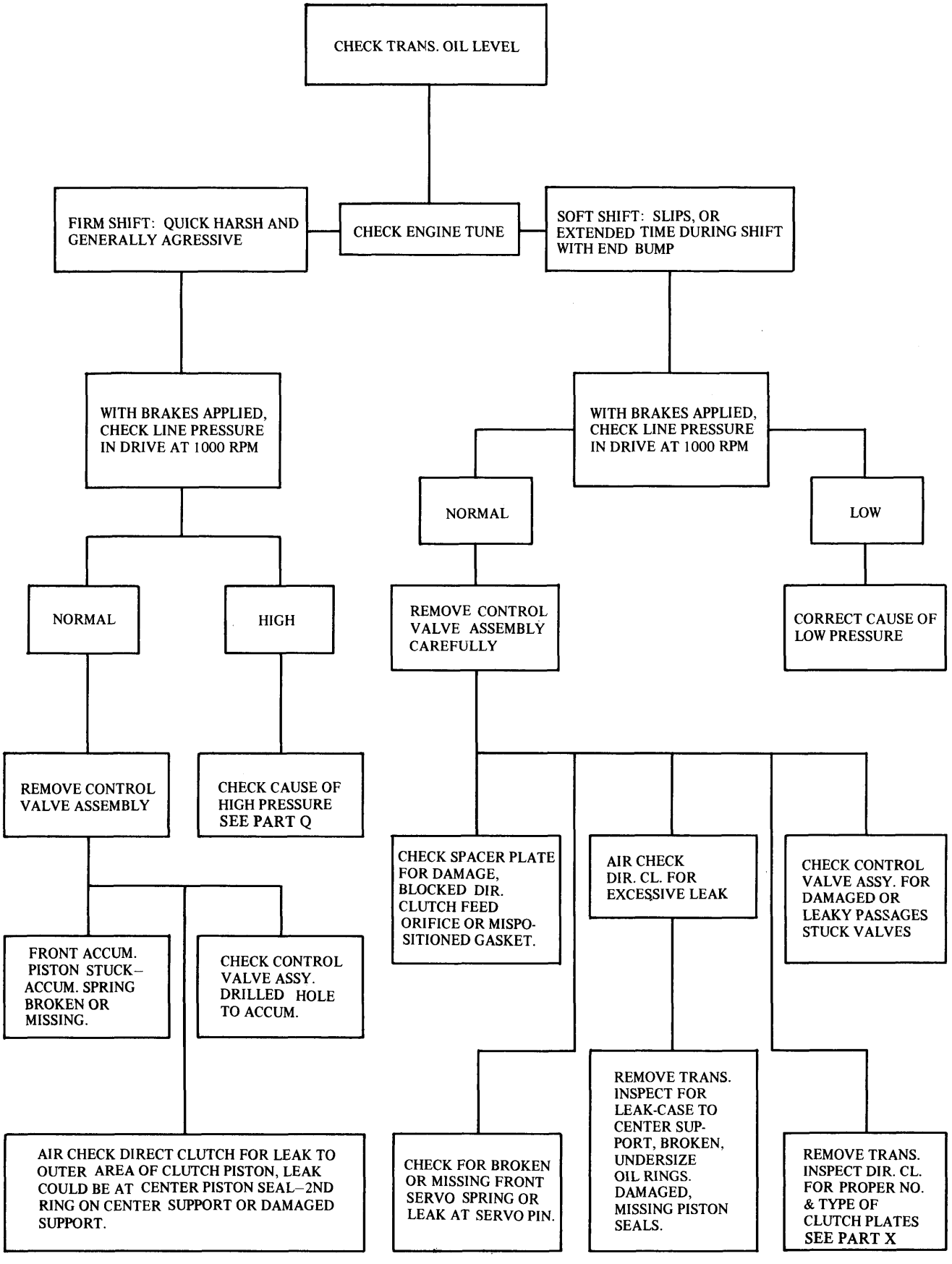
e. 1-2 Shift Feel Complaint–Soft Shift



BACK TO INDEX

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f. 2-3 Shift Complaint



BACK TO INDEX

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g. Drive in Neutral

CHECK OUTSIDE MANUAL LINKAGE & CORRECT

↓

- INTERNAL LINKAGE -
MANUAL VALVE DISCONNECTED OR END BROKEN,
INSIDE DETENT LEVER PIN BROKEN

↓

- PUMP ASSEMBLY -
TRANSMISSION FLUID PRESSURE LEAKING INTO
FORWARD CLUTCH APPLY PASSAGE

↓

- FORWARD CLUTCH -
BURNED PLATES - CHECK CAUSE - PART u
INCORRECT CLUTCH PLATE USAGE - PART x

---

h. Will not Hold in Park or Will Not Release from Park

CHECK OUTSIDE MANUAL LINKAGE & CORRECT, NOTE 3

↓

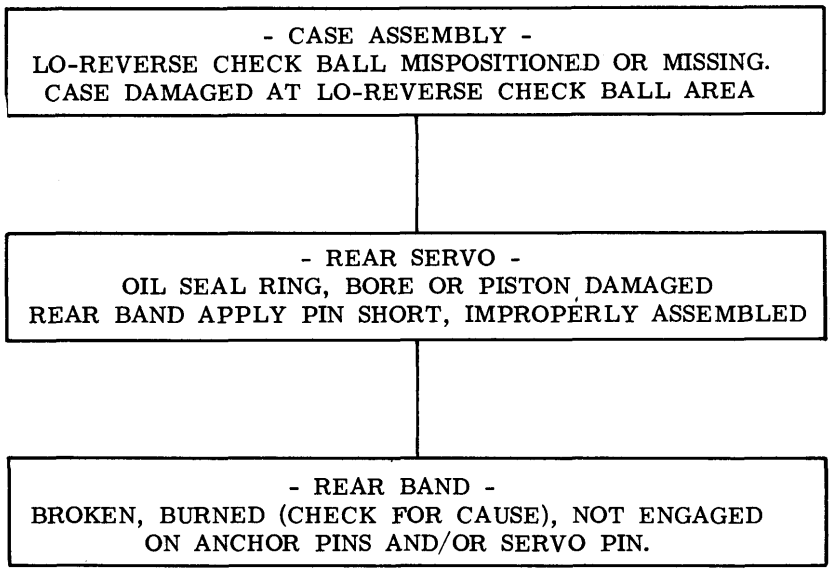
- INTERNAL LINKAGE -

1. Parking brake rod assembly (Check actuator for chamfer)
2. Parking pawl broken, chamfer omitted.
3. Parking brake bracket loose, burr or rough edges or incorrectly installed.
4. Parking pawl return spring missing, broken, incorrectly hooked.
5. Broken lugs on output carrier.

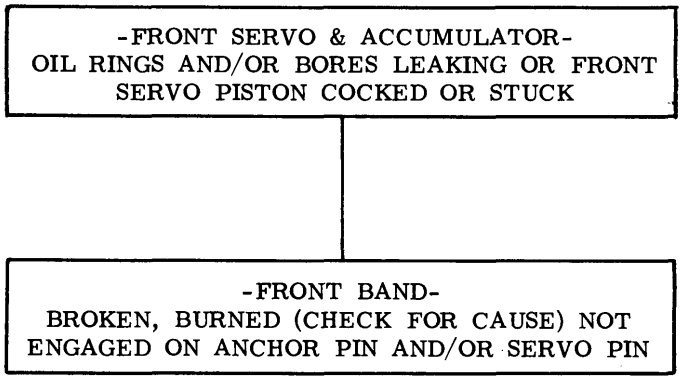
BACK TO INDEX

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i. No Engine Braking—Lo Range—1st Gear



j. No Engine Braking—Intermediate Range—2nd Gear



BACK TO INDEX

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k. No Reverse or Slips in Reverse

CHECK TRANSMISSION OIL LEVEL — NOTE 5

CHECK OUTSIDE MANUAL LINKAGE & CORRECT — NOTE 3

WITH BRAKES APPLIED, CHECK LINE PRESSURE IN REVERSE @ 1000 RPM

NORMAL

- CONTROL VALVE ASSEMBLY -

1. 2-3 Valve train stuck open (This will also cause a 1-3 upshift in drive range)
2. Reverse feed passage - Cross channel leak, porosity in case or valve body passage, gaskets leaking.

- REAR SERVO & ACCUMULATOR -

1. Servo piston seal ring damaged or missing
2. Short band apply pin (This may also cause no overrun braking or slips in overrun braking-lo range)
   Refer to Note 20 for pin selection
3. Rear servo piston or bore.

- FORWARD CLUTCH -
Clutch does not release (will also cause Drive in Neutral)

- DIRECT CLUTCH BURNED -
Check cause - PART u

- REAR BAND -
Broken, burned, loose lining, apply pin or anchor pins not engaged.

CENTER SUPPORT
Oil seal rings or grooves damaged or worn.

LOW

CORRECT CAUSE - PART p

l. 1st and 2nd Speeds Only, No 2-3 Upshift

- CONTROL VALVE ASSEMBLY -
STUCK 2-3 VALVE, GASKET MISPOSITIONED OR LEAKING

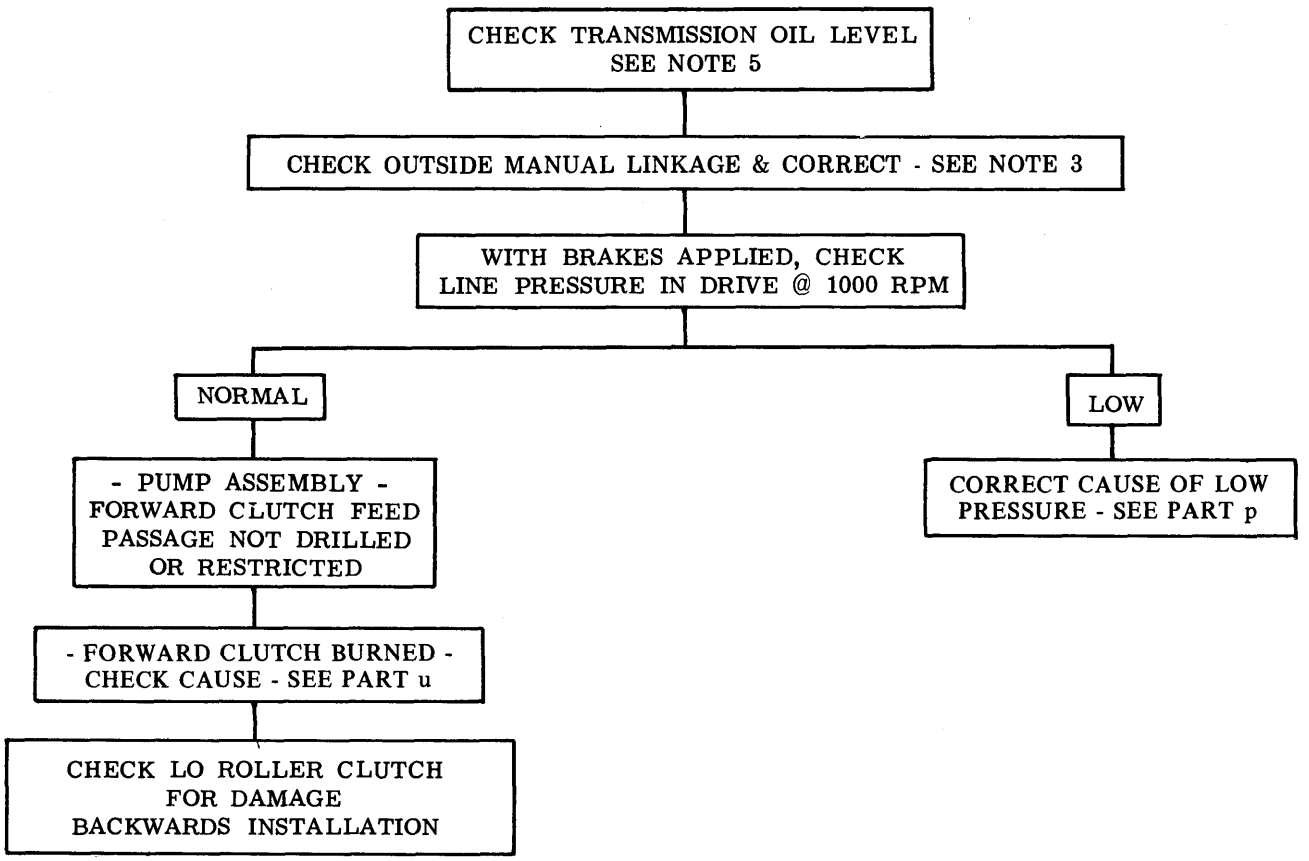
- DIRECT CLUTCH -
BURNED, CHECK CAUSE - Part u

-IMPROPER VACUUM -
CHECK CAUSE, PART r

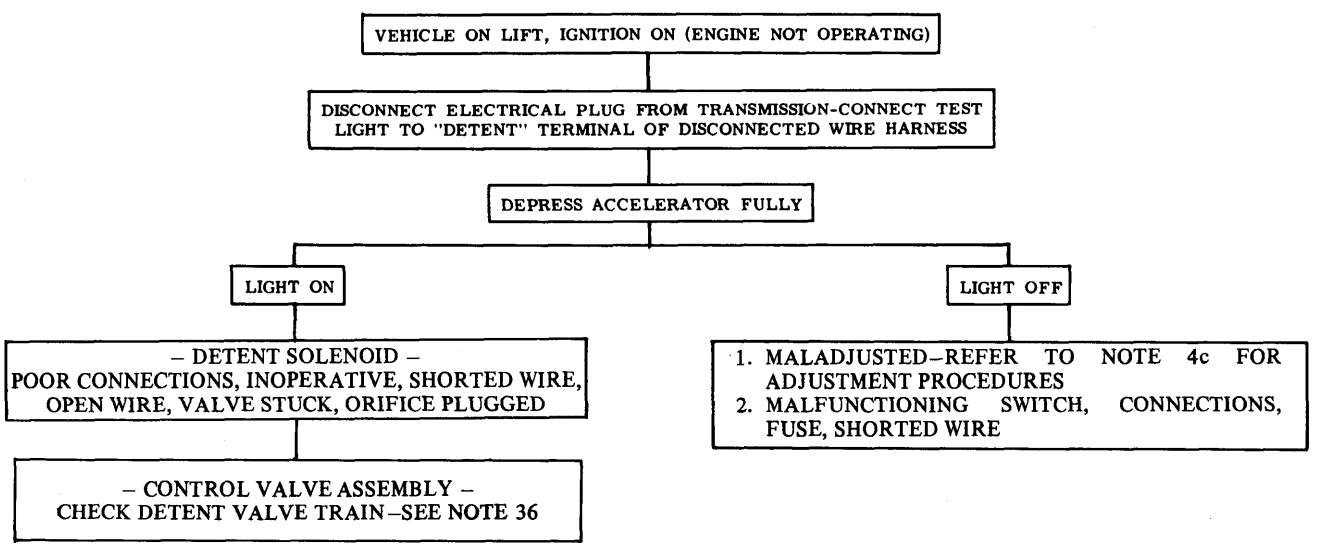
BACK TO INDEX

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m. No Drive in Drive Range



n. No Detent Downshifts

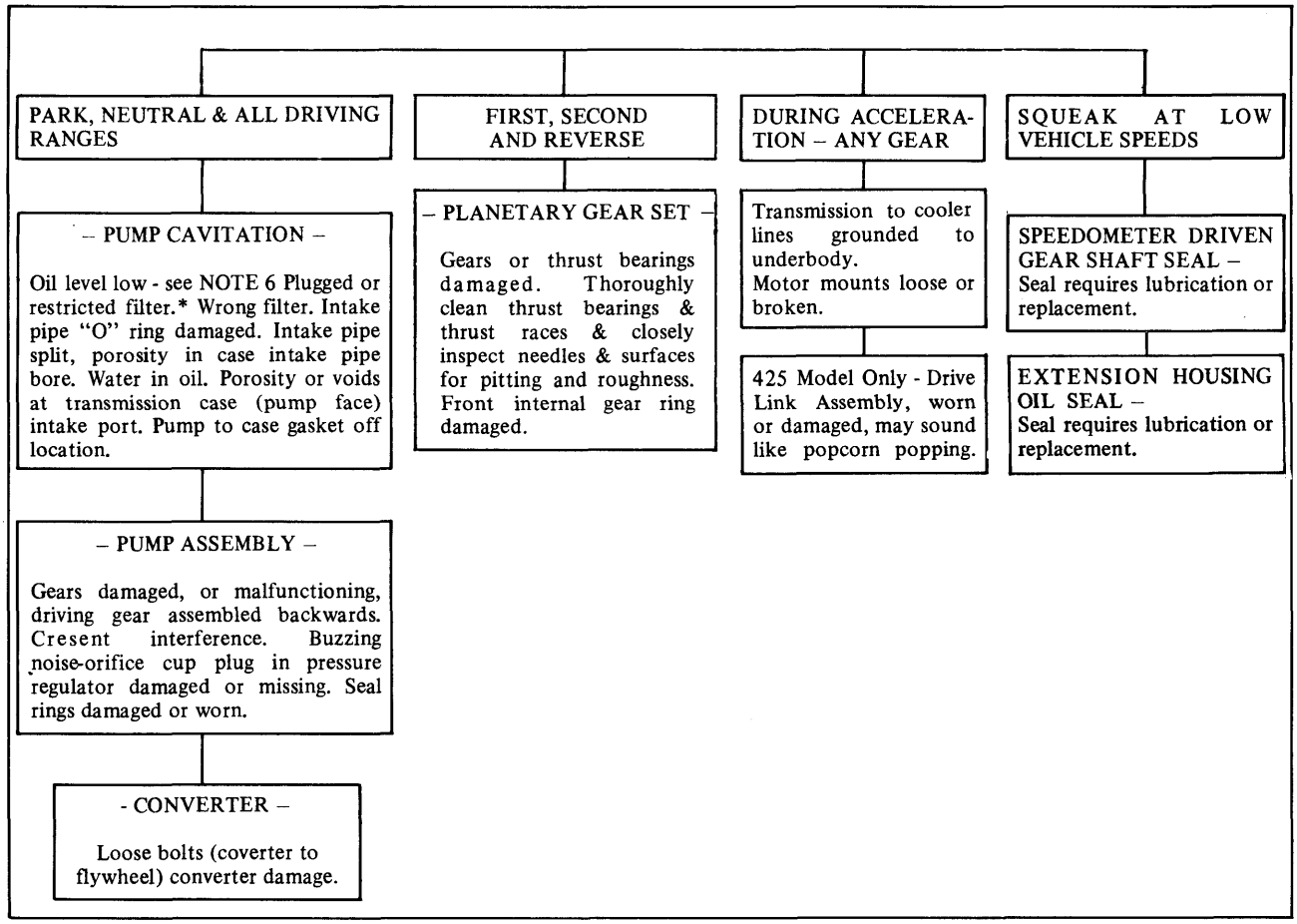


BACK TO INDEX

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o. Transmission Noisy

(NOTE: Before checking transmission for what is believed to be "Transmission Noise," make certain the noise is not from the water pump, generator, air conditioner, power steering. etc. These components can be isolated by removing the proper belt and running the engine no more than two minutes at one time.)



*There is no approved service procedure for checking or cleaning the filter. If the filter is suspected of being plugged or restricted, it must be replaced.

p. Cause of Low Line Pressure

1. Low Transmission Oil Level.
2. Modulator Assembly see Part V.
3. Filter.
   A. Blocked or restricted.*
   B. "O" Ring on intake pipe and/or grommet omitted or damaged.
   C. Split or leaking intake pipe.
   D. Wrong filter assembly.
4. Pump.
   A. Pressure regulator or boost valve stuck.
   B. Gear clearance, damaged worn. (Pump will become damaged if drive gear is installed backwards, or if converter pilot does not enter crankshaft freely).
   C. Pressure regulator spring, too weak.
   D. Not enough spacers in pressure regulator.
   E. Pump to case gasket mispositioned.
   F. Malfunctioning pump body and/or cover.
   G. Mismatch pump cover/pump body.
5. Internal Circuit Leaks.
   A. Forward clutch leak (pressure normal in neutral and reverse-pressure low in drive).
   1. Check pump rings.
   2. Check forward clutch seals.
   B. Direct clutch leak (pressure normal in neutral, low, intermediate, and drive–pressure low in reverse).
   1. Check center support oil seal rings.
   2. Check direct clutch outer seal for damage.
   3. Check rear servo and front accumulator pistons and rings for damage or missing.
6. Case Assembly.
   A. Porosity in intake bore area.
   B. Check case for intermediate clutch plug leak or missing plug.
   C. Lo-reverse check ball mispositioned or missing (this will cause no reverse and no overrun braking in Lo range).

*There is no approved service procedure for checking or cleaning the filter, if the filter is suspected of being plugged or restricted. It must be replaced.

BACK TO INDEX

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q. Causes of High Line Pressure

1. Vacuum Leak.
   A. Full leak (vacuum line disconnected.)
   B. Partial leak in line from engine modulator.
   C. Improper engine vacuum.
   D. Vacuum operated accessory leak. (Hoses, vacuum advance, etc.).
2. Damaged Modulator.
   A. Stuck valve.
   B. Water in modulator.
   C. Not operating properly - Part v.
3. Detent System.
   A. Detent switch actuated (plunger stuck) or shorted.
   B. Detent wiring shorted.
   C. Detent solenoid stuck open.
   D. Detent feed orifice in spacer plate blocked.
   E. Detent solenoid loose.
   F. Detent valve bore plug damaged.
   G. Detent regulator valve pin short.
4. Pump.
   A. Pressure regulator and/or boost valve stuck.
   B. Incorrect pressure regulator spring.
   C. Too many pressure regulator valve spacers.
   D. Pump casting bad.
   E. Pressure boost valve installed backwards or malfunctioning.
   F. Aluminum bore plug has hole or otherwise malfunctioning.
   G. Pressure boost bushing broken or otherwise malfunctioning.
5. Control Valve Assembly.
   A. Spacer plate-to-case gasket off location.
   B. Wrong spacer plate-to-case gasket.

r. Causes of Improper Vacuum at Modulator

1. Engine.
   A. Requires tune up.
   B. Loose vacuum fittings.
   C. Vacuum operated accessory leak (hoses, vacuum advance, etc.)
2. Vacuum Line to Modulator.
   A. Leak
   B. Loose fitting.
   C. Restricted orifice, or incorrect orifice size.
   D. Carbon build up at modulator vacuum fitting.
   E. Pinched line.
   F. Grease or varnish material in pipe (no or delayed upshift-cold).

s. Causes of Oil Leaks

1. Transmission Oil Pan Leaks.
   A. Attaching screws not correctly torqued.
   B. Improperly installed or damaged pan gasket.
   C. Oil pan gasket mounting face not flat.
2. Case Extension Leak.
   A. Attaching screws not correctly torqued.
   B. Rear seal assembly—damaged or improperly installed. (Propeller shaft yoke damaged)
   C. Gasket—(Extension to case) damaged or improperly installed.
   D. Porous casting.
   E. Output shaft "O" ring damaged.
3. Case Leak.
   A. Filler pipe "O" ring seal damaged or missing; misposition of filler pipe bracket to engine—"Loading" one side of the "O" ring.
   B. Modulator assembly "O" ring seal—damaged or improperly installed.
   C. Connector "O" ring seal—damaged or improperly installed.
   D. Governor cover, gasket and screws—damaged, loose; case face leak.
   E. Damaged or porosity. Leak at speedometer driven gear housing or seal. Leak at speedometer hole plug.
   F. Manual shaft seal—damaged, improperly installed.
   G. Line pressure tap plug—stripped, lacking compound.
   H. Vent pipe (refer to Item 5 below).
   I. Porous case, or cracked at pressure plug boss.
4. Front End Leak.
   A. Front seal—damaged (check converter neck for nicks, etc., also for pump bushing moved forward) garter spring missing.
   B. Pump attaching screws, and seals — damaged, missing, screws loose.
   C. Converter—leak in weld.
   D. Pump "O" ring seal—damaged. (Also check pump oil ring groove and case bore).
   E. Porous casting (pump or case).
   F. Pump—drain back hole not open.
5. Oil Comes Out Vent Pipe.
   A. Transmission over-filled.
   B. Water in oil.
   C. Filter "O" ring damaged or improperly assembled causing oil to foam.
   D. Foreign material between pump and case or between pump cover and body.
   E. Case—porous, pump face improperly machined.
   F. Pump—insufficient metal, porous.
   G. Pump to case gasket mispositioned.
   H. Pump breather hole blocked or missing.
   I. Hole in intake pipe.
6. Oil Cooler Lines.
   A. Connections at radiator loose or stripped.
   B. Connections at case loose or stripped.
7. Modulator Assembly.
   Diaphragm leaking - Part v.

t. Control Valve Assembly—Governor Line Pressure Check

1. Install line pressure gage.
2. Disconnect vacuum line to modulator.
3. With car on hoist (drive wheels off ground), foot off brake, in drive, check line pressure at 1000 RPM.
4. Slowly increase engine RPM to 3000 RPM and determine if a line drop occurs (10 psi or more).
5. If pressure drop occurs, disassemble, clean and inspect control valve assembly.
6. If no pressure drop occurs:
   A. Inspect governor.
   1. Stuck valve.
   2. Weight freeness.

BACK TO INDEX

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3. Restricted orifice in governor valve.

B. Governor feed system.

1. Check screen in governor feed pipe hole in case assembly.

2. Check for restrictions in governor pipe.

u. Causes of Burned Clutch Plates

(NOTE: Burned clutch plates can be caused by incorrect usage of clutch plates. Also, anti-freeze in transmission fluid can cause severe damage, such as large pieces of composition clutch plate material peeling off.)

1. Forward Clutch.

A. Check ball in clutch housing damaged, stuck or missing.

B. Clutch piston cracked, seals damaged or missing.

C. Low line pressure.

D. Manual valve mispositioned.

E. Restricted oil feed to forward clutch (Examples: Clutch housing to inner and outer areas not drilled, restricted or porosity in pump).

F. Pump cover oil seal rings missing, broken or undersize; ring groove oversize.

G. Case valve body face not flat or porosity between channels.

H. Manual valve bent and center land not ground properly.

2. Intermediate Clutch.

A. Rear accumulator piston oil ring, damaged or missing.

B. 1-2 accumulator valve stuck in control valve assembly.

C. Intermediate clutch piston seals damaged or missing.

D. Center support screw loose.

E. Low line pressure (See Part p).

F. Intermediate clutch plug in case missing.

G. Case valve body face not flat or porosity between channels.

H. Manual valve bent and center land not ground properly.

3. Direct Clutch.

A. Restricted orifice in vacum line to modulator (poor vacuum response.)

B. Check ball in direct clutch piston damaged, stuck or missing.

C. Leaking Modulator bellows - Part v.

D. Center support screw loose. (Screw may be tight in support but not holding support tight to case.)

E. Center support oil rings or grooves damaged or missing.

F. Clutch piston seals damaged or missing.

G. Front and rear servo pistons and seals damaged.

H. Manual valve bent and center land not cleaned up.

I. Case valve body face not flat or porosity between channels.

J. Intermediate roller clutch installed backwards.

K. 3-2 valve, 3-2 spring or 3-2 spacer pin installed in wrong location in 3-2 valve bore.

(NOTE: If direct clutch plates and front band are burned, check manual linkage. See Note 3.)

v. Vacuum Modulator Assembly (Fig. 7-4)

The following procedure is recommended for checking Turbo Hydra-matic modulator assemblies in the field before replacement is accomplished.

1. Vacuum Diaphragm Leak Check. Insert a pipe cleaner into the vacuum connector pipe as far as possible and check for the presence of transmission oil. If oil is found, replace the modulator.

CAUTION: Gasoline or water vapor may settle in the vacuum side of the modulator. If this is found without the presence of oil, the modulator should not be changed.

2. Atmospheric Leak Check. Using Hand Vacuum Pump, J-23738, apply 20" HG to diaphragm. Modulator should hold vacuum for 10 seconds. If vacuum drops, replace modulator.

3. Bellows Comparison Check. Make a comparison gage, as shown in Fig. 7-5, and compare the load of a known good Hydra-matic modulator with the assembly in question. Modulator Tension Tester J-24466 may also be used for this purpose.

a. Install the modulator of the same size that is known to be acceptable on either end of the gage.

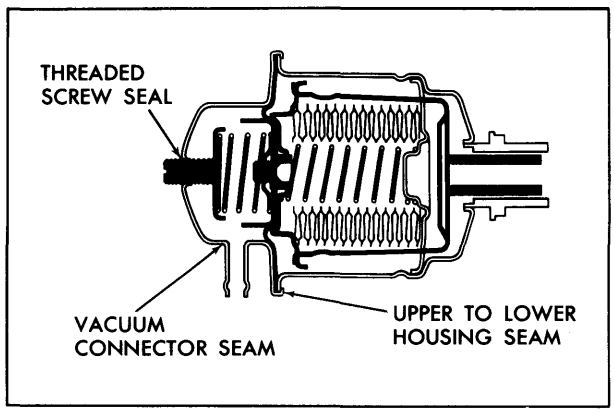


Fig. 7-4 Vacuum Modulator Cutaway View

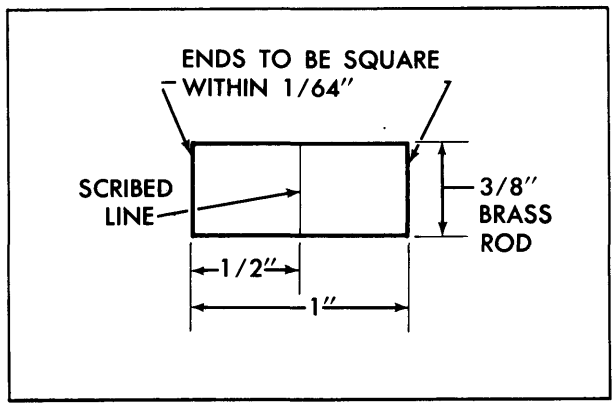


Fig. 7-5 Vacuum Modulator Test Gage

BACK TO INDEX

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b. Install the modulator in question on the opposite end of the gage.

c. Holding the modulators in a horizontal position, bring them together under pressure until either modulator sleeve end just touches the line in the center of the gage. The gap between the opposite modulator sleeve end and the gage line should then be 1/16" or less. If the distance is greater than this amount, the modulator in question should be replaced.

4. Sleeve Alignment Check. Roll the main body of the modulator on a flat surface and observe the sleeve for concentricity to the can. If the sleeve is concentric and the plunger is free, the modulator is acceptable.

Once the modulator assembly passes all of the above tests, it is an acceptable part and should be re-used.

w. Downshift Solenoid Circuit Check

(NOTE: Before checking the downshift solenoid circuitry, make certain that the transmission downshift switch is properly adjusted as described in Note 4.)

1. With transmission shift lever in Park, turn ignition switch to "ON" position, but do not start car. Leave ignition switch "ON" throughout checking procedure.

2. Working under hood, slowly advance throttle linkage to wide open position. One click should be heard from transmission.

3. Allow throttle to return to closed position. One click should be heard from transmission.

4. If system performed as described above, downshift circuit is operating properly. If system does not perform as described above, proceed to step 5.

5. Use test light to check orange wire at connector on side of transmission case. Test light should light with throttle wide open and go out when throttle is released.

a. If system operates as described above, but did not perform properly during steps 1-3, replace solenoid after first checking to see that internal wiring is operational. Solenoid installation described in note 52 must be followed.

b. If light fails to light with throttle in wide open position, the circuit is open, proceed to step 6.

c. If light lights with throttle closed, the circuit is shorted. Proceed to step 9.

6. Remove air cleaner. Remove orange wire connector at transmission downshift switch. Use test light to check from the bare terminal at switch with throttle wide open.

a. If test light lights, replace orange wire. Recheck system.

b. If test light fails to light, proceed to step 7.

7. Check black striped orange feed wire at transmission downshift switch with test light.

a. If test light lights, replace transmission downshift switch. Recheck system.

b. If test light fails to light, proceed to step 8.

8. Check 10 amp (gages and transmission control fuse) in fuse panel.

a. If necessary to replace fuse, recheck system.

b. If fuse is all right, it will be necessary to locate the open in the wiring. Test the circuit continuity from the black-striped orange wire at the downshift switch to the battery.

9. Remove air cleaner. Remove orange wire connector at transmission downshift switch. Use test light to check from the bare terminal at switch with throttle closed.

a. If test light fails to light, orange wire is shorted. Correct shorting condition.

b. If test light lights, proceed to step 10.

10. With throttle in closed position, check black striped orange feed wire at transmission downshift switch.

a. If test light fails to light, replace transmission downshift switch. Recheck system.

b. If test light lights, it will be necessary to locate the short in the wiring. Test the circuit from the black striped orange wire at the downshift switch to the battery.

x. Type AA-AB Clutch Parts

Clutch	No. of Flat Steel Clutch Plates	No. of Waved Steel Clutch Plates
Forward Clutch	*4	1
Direct Clutch	*5	1
Intermediate Clutch	2	1

*Steel Plate Thickness - .0915"

Clutch	No. of Clutch Composition Plates	No. of Piston Release Springs
Forward Clutch	5	16
Direct Clutch	6	14
Intermediate Clutch	3	3

BACK TO INDEX

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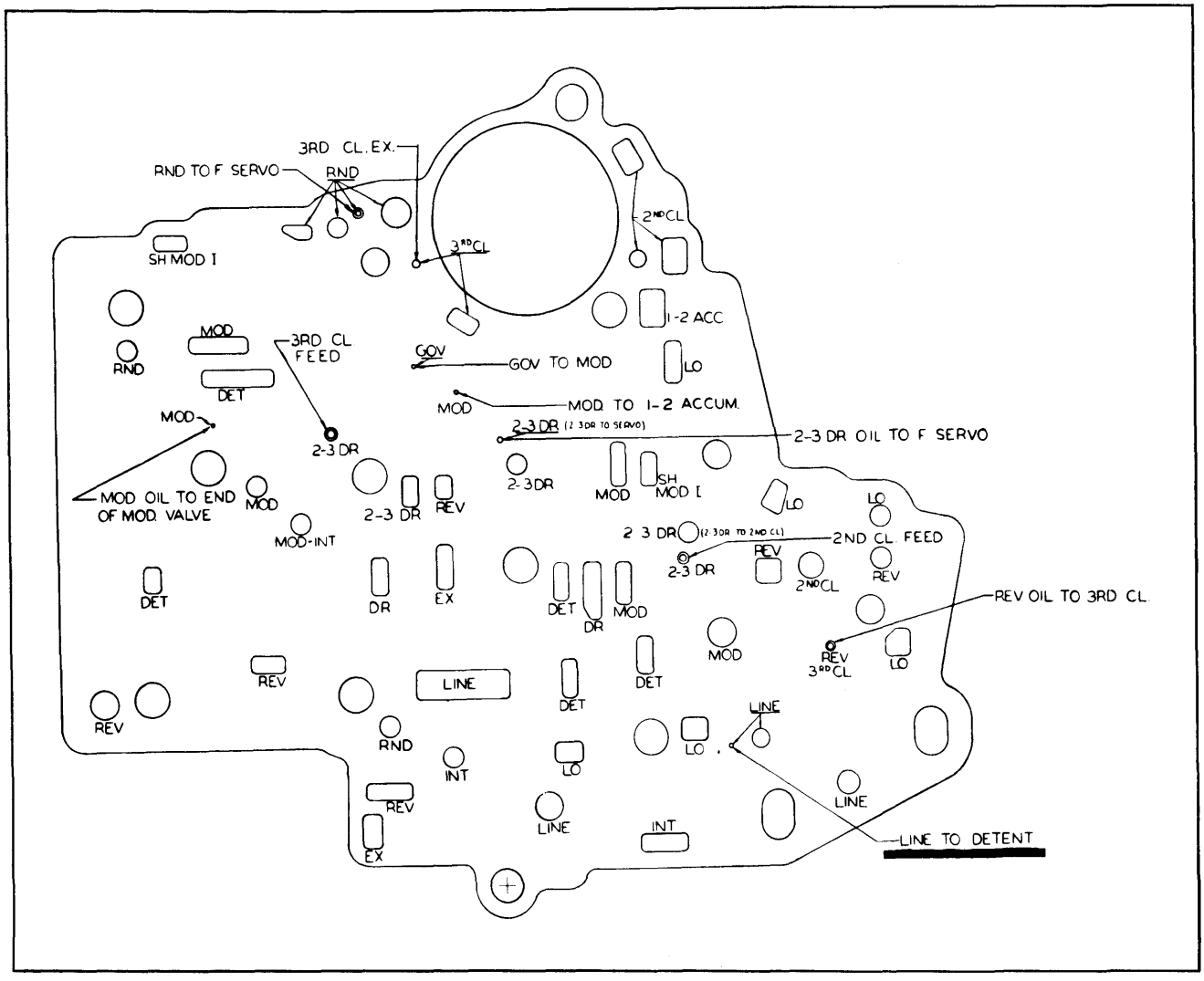


Fig. 7-6 Spacer for control Valve Assembly (Typical)

SERVICE INFORMATION

1. Transmission Case Repairs

a. Repairing Tapped Holes

Thread repair inserts are available from various sources and are recommended for restoring damaged threads. The instructions provided with your specific repair kit should be followed.

b. Repairing Case Porosity

Leaks caused by case porosity can be successfully repaired with the transmission in the car, using the following procedure:

1. Road test and bring transmission to operating temperature approximately 170 degrees.
2. Raise car on a hoist with engine running and locate source of oil leak.

(NOTE: Use of a mirror is helpful in finding leaks.)

3. Shut engine off and thoroughly clean area to be repaired with a cleaning solvent and a brush. Air dry.

(NOTE: A clean, dry soldering acid brush can be used to clean the area and also to apply the epoxy cement.)

4. Using instructions provided, mix a sufficient amount of epoxy, No. 136 0016, or equivalent to make repair.

(NOTE: Observe cautions of manufacturer in handling.)

5. While the transmission case is still HOT, apply the epoxy to the area to be repaired.

(NOTE: Make certain the area to be repaired is fully covered.)

6. Allow cement to cure for three hours before starting engine.
7. Road test and check for leaks.

2. Oil Leaks

The precautions that must be observed to prevent fluid leaks are as follows:

1. Use new gaskets and O-ring seals whenever there

BACK TO INDEX
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is a disassembly.

2. Use a very small amount of petrolatum to hold gaskets and thrust washers in place during assembly, or to seal gaskets. Never use gasket paste or shellac.

3. Make sure that composition cork and paper gaskets are not wrinkled or creased when installed. Make sure that gaskets have not stretched or shrunk during storage.

4. Make sure the square type O-ring seals are installed squarely and are not twisted during assembly.

5. Make sure that mating surfaces of castings are flat and smooth, free of deep scratches, chips, and burrs.

6. Torque fasteners to proper torque.

When checking for oil leaks, first determine whether leak originates from transmission or engine. The original factory fill fluid in the transmission is formulated with a red aniline dye to assist in locating leaks. Red dye appearing in the leaking oil will give positive identification as to the location of the leak.

If oil leak is found to be in transmission, check for leak in following areas:

a. Front End

It will be necessary to remove lower cover at front of transmission case to determine location of leaks at front end. To correct leaks at front end, it will be necessary to remove transmission from car.

1. Pump oil seal leak - Check pump oil seal to make certain it is correctly installed and not damaged.

When installing a new pump oil seal, Note 12, make certain that bore is free from foreign material and that garter spring on seal is correctly positioned. Check finish of converter neck and bearing surface in pump body.

2. Pump assembly-to-case square cut O-ring or gasket damaged.

3. Rubber coated-washers on pump attaching screws damaged or missing.

4. Converter - Inspect converter for indications of leakage. See Note 13, for checking procedure.

5. Pump drain back hole not open Fig. 7-11.

b. Extension Housing

1. Extension housing oil seal not installed properly or damaged.

2. Gasket (extension housing-to-case) improperly installed or damaged.

3. Extension housing-to-case attaching screws not torqued to specifications. Tighten to 23 foot-pounds.

4. Porous or cracked casting.

5. Propeller shaft front slip yoke scratched or corroded.

6. O-ring on output shaft, improperly installed or damaged.

c. Transmission Case

1. Speedometer driven gear housing retainer attaching screw loose. Tighten to 18 foot-pounds.

2. Speedometer driven gear housing O-ring or lip seal damaged.

3. Governor cover attaching screws not tight. Tighten screws to 18 foot-pounds.

4. Damaged governor gasket.

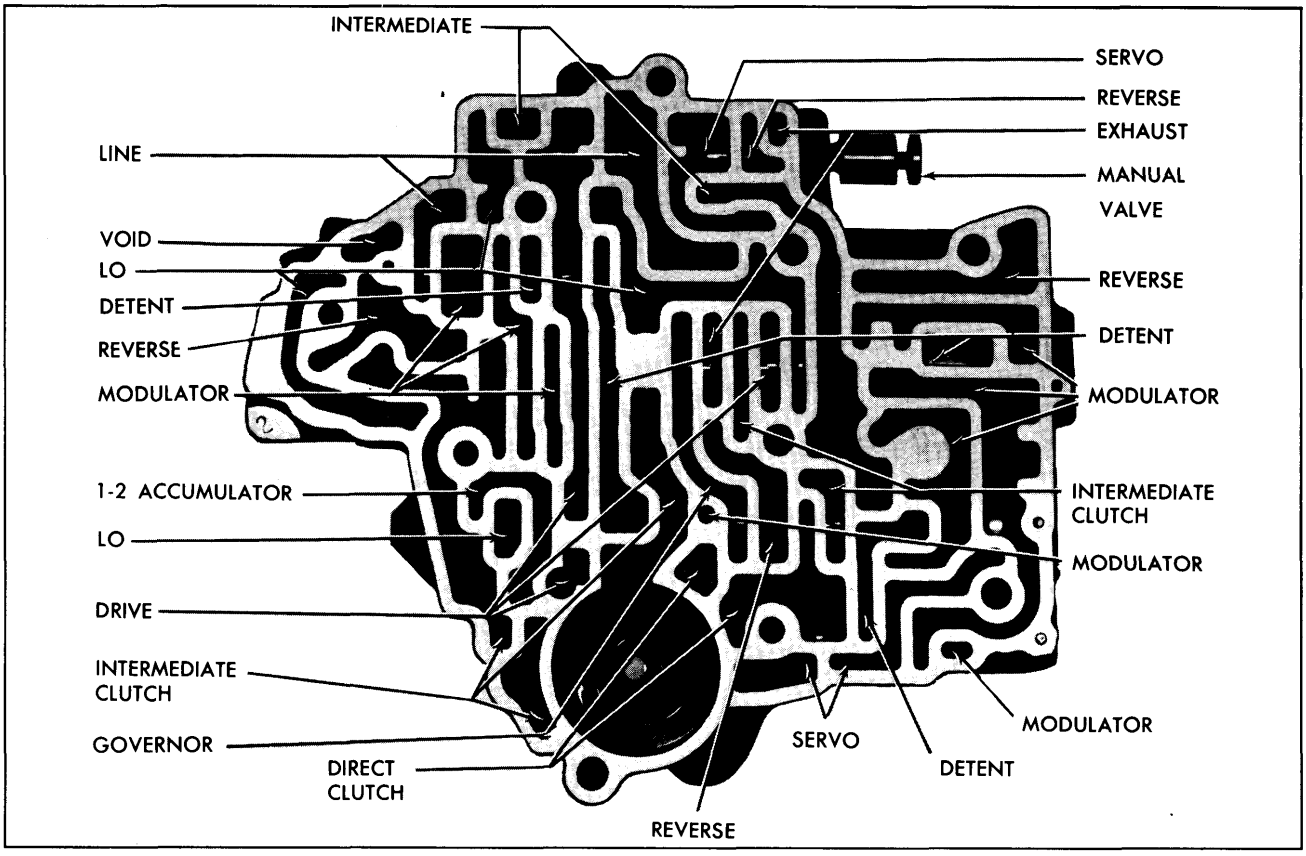


Fig. 7-7 Control Valve Body Oil Passages

BACK TO INDEX

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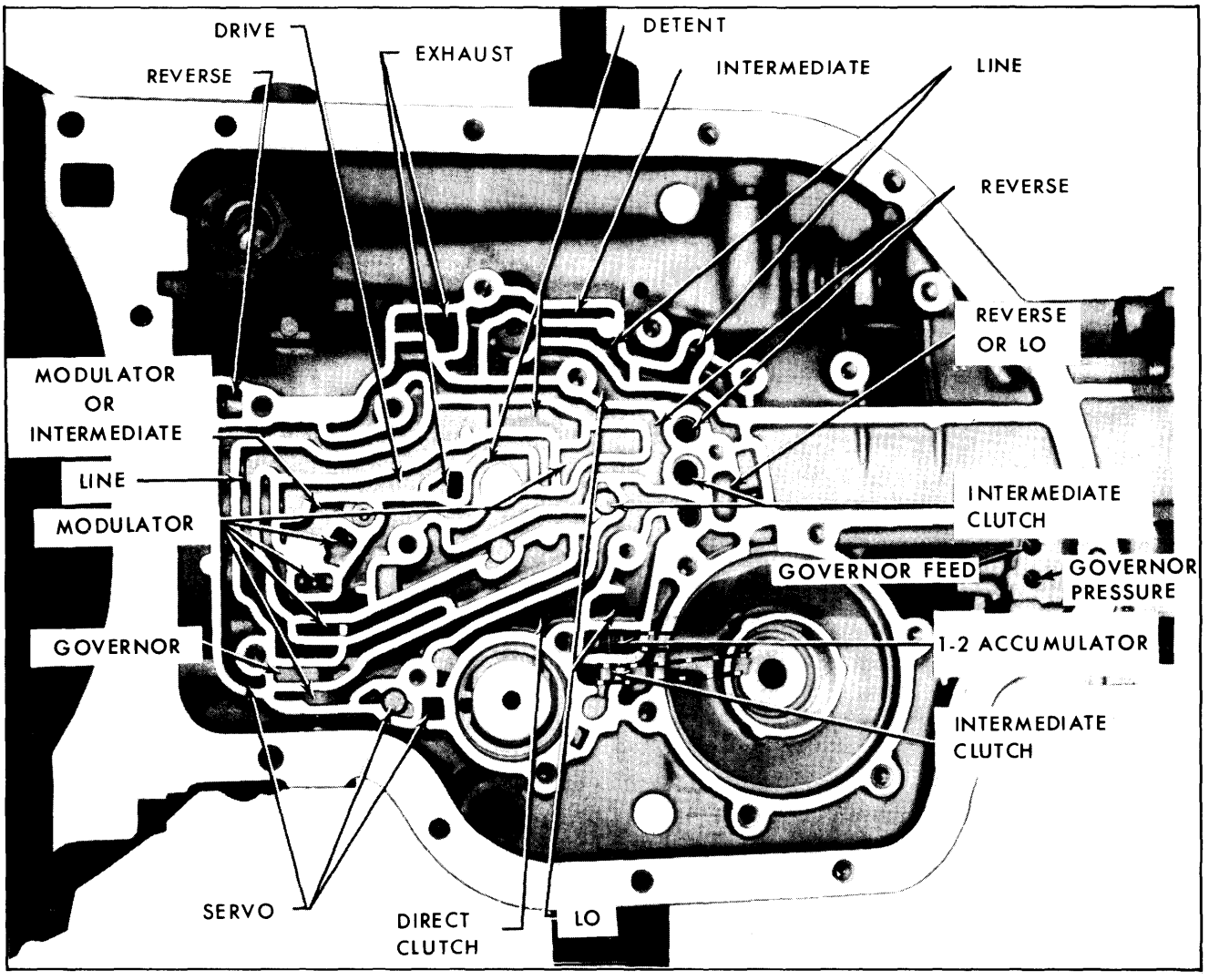


Fig. 7-8 Transmission Case Oil Passages (Bottom View)

5. Electrical connector O-ring damaged.
6. Parking pawl shaft cup plug not properly installed.
7. Manual shaft seal damaged.
8. Vacuum modulator damaged.
9. Vacuum modulator retainer screw loose. Tighten to 18 foot-pounds.
10. Vacuum modulator diaphragm damaged.

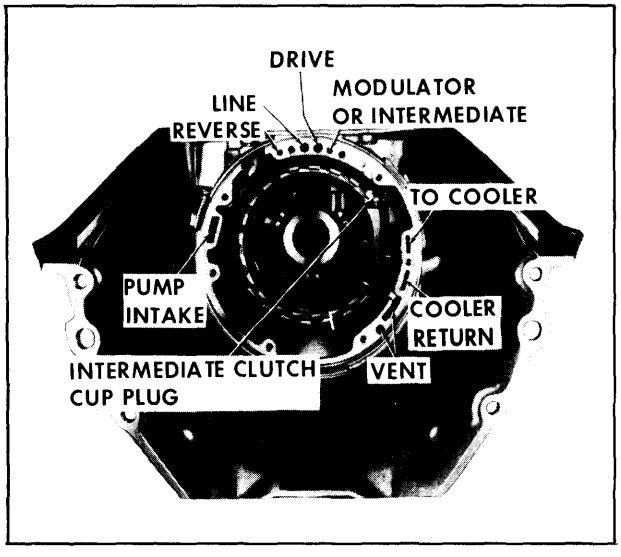


Fig. 7-9 Transmission Case Oil Passages

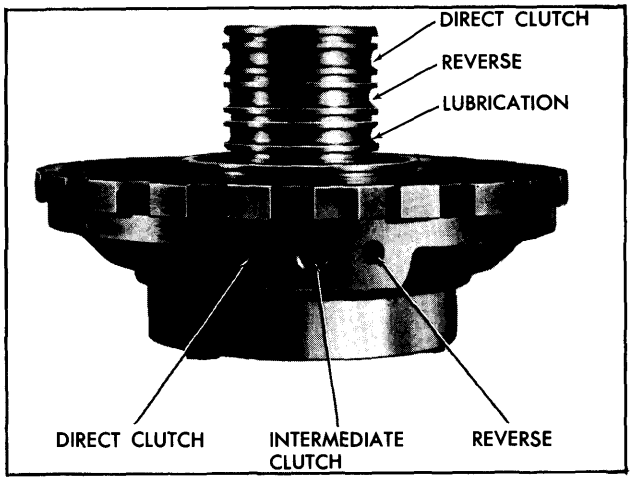


Fig. 7-10 Center Support Oil Passages

BACK TO INDEX

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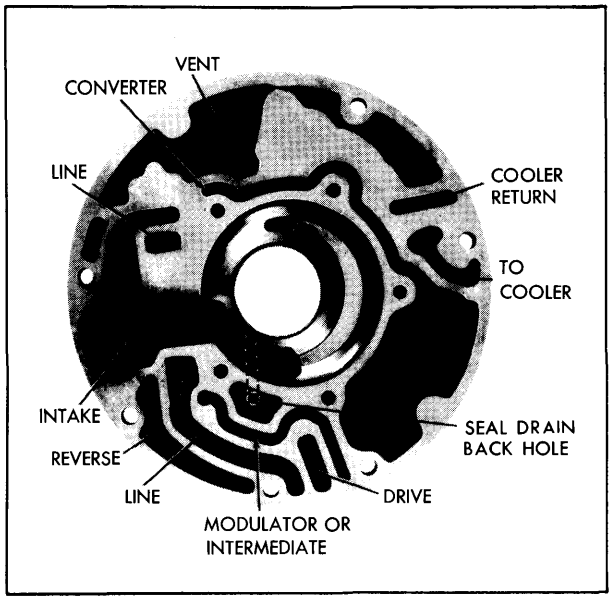


Fig. 7-11 Pump Body Oil Passages

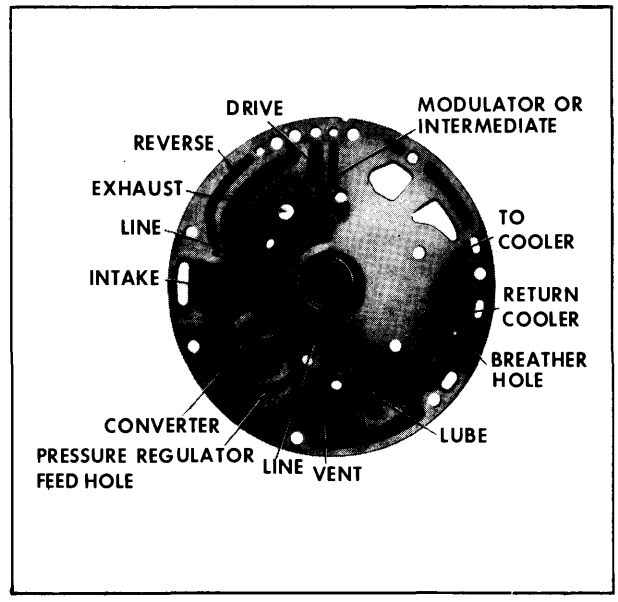


Fig. 7-12 Pump Cover Oil Passages

(NOTE: A ruptured diaphragm would allow transmission oil to be drawn into intake manifold and vacuum line. Usually the exhaust will be excessively smoky due to transmission oil added to the combustion. Oil level of transmission will also be low with no visible external leak.)

11. Bottom pan gasket damaged.
12. Bottom pan attaching screws loose. Tighten to 12 foot-pounds.
13. Line pressure plug not tight. Tighten to no more than 10 foot-pounds.
14. Porous or cracked casting.
15. Vent pipe.
a. Transmission over-filled.
b. Water in oil.
c. Pump to case gasket mispositioned.
d. Foreign material between pump and case, or between pump cover and body.
e. Case - Porous pump face improperly machined.
f. Pump - Shy of stock, porous. Breather hole in pump cover plugged, Fig. 7-12.
g. Cut O-ring or intake or grommet on filter assembly.

d. Oil Cooler Pipe Connections

1. Outside oil cooler pipe connections improperly installed or damaged. Also connectors in radiator and transmission.
2. Oil cooler pipe connections not tight. Tighten to 20 foot-pounds.
3. Flare on oil cooler pipes damaged at radiator or transmission.

e. Leaking Out Filler Pipe

1. O-ring damaged or improperly installed on pipe.
2. Filler pipe not fully seated in case.

f. Blowing Out Filler Pipe

1. Transmission over-filled.
2. Plugged vent cap.
3. Plugged vent hole in pump.
4. Damaged pump gasket.
5. Engine overheating.

g. Internal Leaks

It will be necessary to remove bottom pan to determine location of internal leaks.
1. Governor pipes damaged.
2. Rear servo cover attaching screws not tight. Tighten to 18 foot-pounds.
3. Rear servo cover gasket damaged.
4. Control valve assembly spacer plate-to-case gasket damaged.
5. Control valve assembly attaching screws loose. Tighten to 8 foot-pounds.
6. Solenoid gasket damaged.
7. Solenoid attaching screws loose. Tighten to 10 foot-pounds.
8. Intake pipe O-ring or filter grommet damaged causing a foaming condition.
9. Rear servo square cut O-ring improperly installed or damaged.

3. Manual Linkage Adjustments (Fig. 7-13)

1. Loosen adjusting screw on steering column shift rod to trunnion assembly swivel.
2. Working under car, pull trunnion lever up to position transmission shift valve in Park, then pull lever down to the third (Neutral) step. Make sure lever is centered in this detent position.
3. Position selector lever in Neutral detent in steering column.
4. Tighten adjusting screw.
5. Check operation of selector lever by performing the following steps:
a. Lift lever and move to neutral detent. (This is the detent in the transmission.) Release the lever and

BACK TO INDEX
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check to make sure that the lever fits into neutral notch in steering column.

b. Move lever to Drive detent. There should be a slight travel of the lever beyond this detent until the drive stop in the steering column is reached.

c. Move lever to Reverse detent and check as in b above.

WARNING: WHENEVER LINKAGE IS READJUSTED, CHECK FOR PROPER OPERATION OF SEAT BELT WARNING SWITCH, PARKING BRAKE RELEASE, BACK-UP LIGHTS AND COLUMN LOCK IN PARK. REFER TO SECTION 12 FOR PROPER METHOD OF CHECKING FUNCTION OF SEAT BELT WARNING SWITCH.

4. Transmission Downshift Switch

a. Removal

1. Remove air cleaner.
2. Disconnect wire connectors.
3. Remove 2 screws that secure switch to switch bracket and remove downshift switch.

b. Installation

1. Hold switch in on-car position and rotate switch actuating shaft clockwise until it stops. Install lever on shaft with notch on inside and lever in straight-up position.
2. Insert shaft into hole on throttle adapter plate.
3. Insert two mounting screws through switch mounting to mounting bracket and lightly tighten. tighten.
4. Adjust switch as described in Part c.
5. Connect wires to terminals on switch.
6. Replace air cleaner.

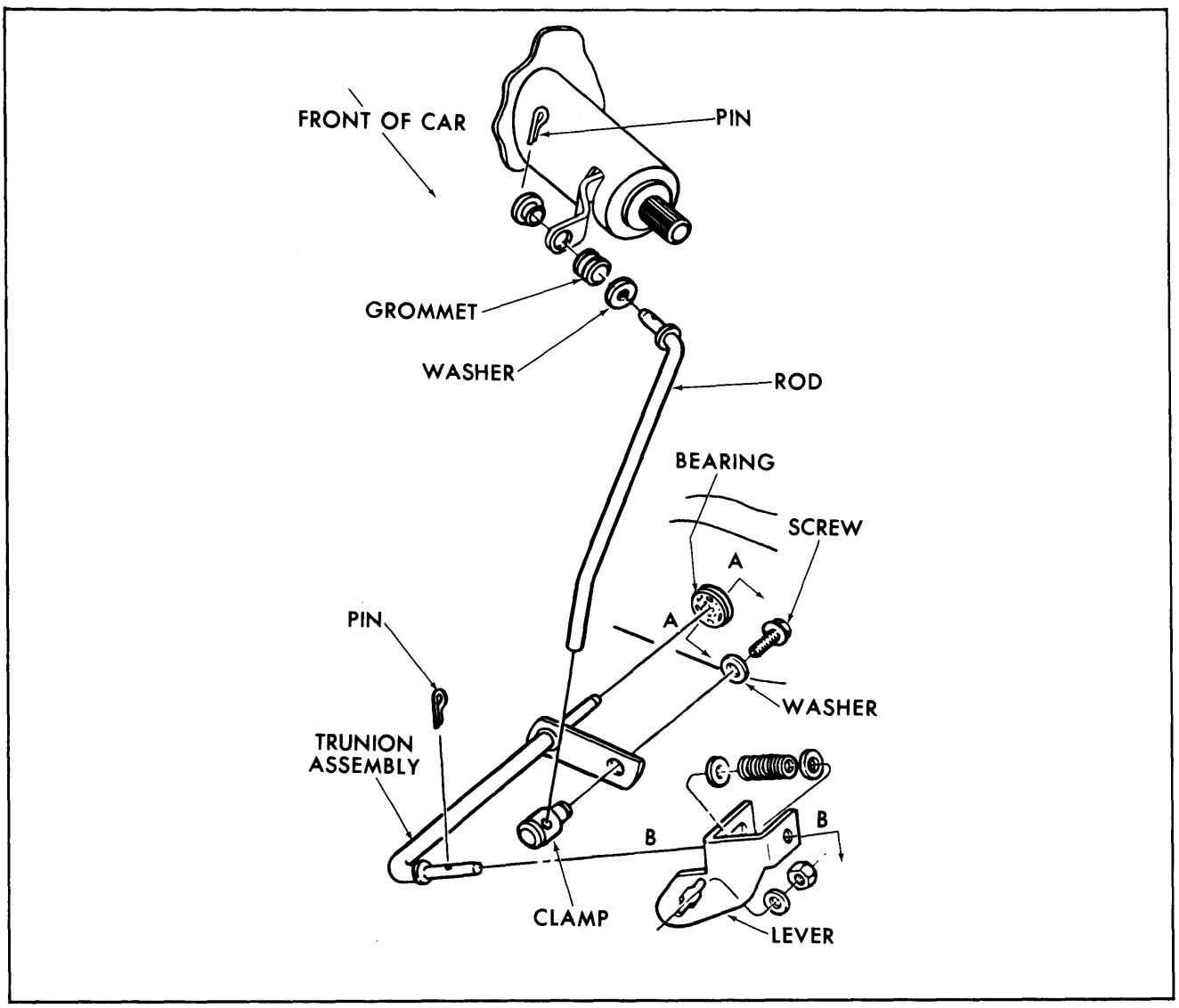


Fig. 7-13 Transmission Linkage

BACK TO INDEX

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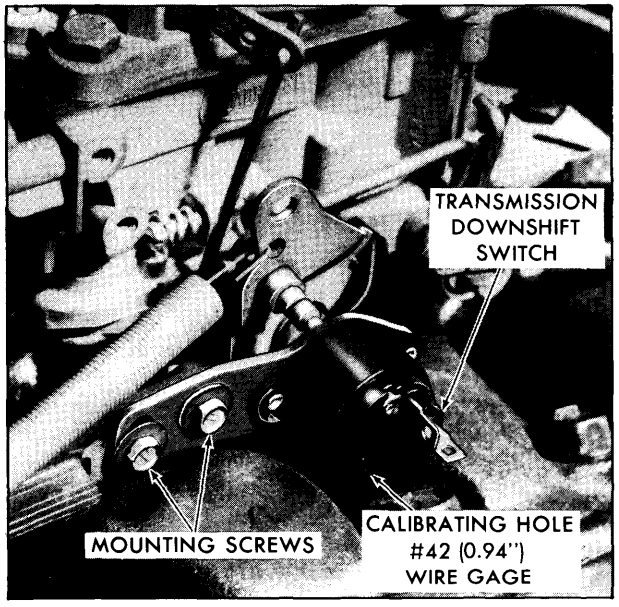


Fig. 7-14 Downshift Switch

c. Adjustment

1. Remove carburetor air cleaner.
2. Make certain that carburetor is adjusted to specification and that throttle linkage is at low speed idle setting.
3. Loosen two mounting screws and insert a #42 (.094") wire gage size drill into the calibrating hole below lower wire terminal, Fig. 7-14. Adjust position of switch so that lever just touches the carburetor adapter plate arm (stud on 6L).

With this adjustment the downshift switch should make contact above 60° throttle.

4. With swtich positioned, tighten mounting screws and remove #42 (.094") gage from calibrating hole through switch.
5. Repeat step 3, if necessary.
6. Install air cleaner.

(NOTE: When checking downshift switch on car with E.F.I. refer to 1975 Supplement E.F.I., Fig. 7-28 Throttle Linkage.)

5. Checking and Adding Fluid

(NOTE: When checking fluid level the oil temperature and having the car on a level surface are particularly important. Careful attention to the following procedures is necessary in order to determine the actual fluid level.)

a. Turbo Hydra-Matic Oil Recommendations

Whenever fluid is added, use only DEXRON ® -II type transmission fluid, or fluids of equivalent quality that have been especially formulated and tested for use in the Turbo Hydra-matic transmission.

The transmission dipstick and filler tube is located under the hood at the right rear top of the engine.

Under normal driving conditions, the transmission filter and fluid should be changed every 100,000 miles. If the car is driven extensively in heavy city traffic during hot weather, or is used to pull a trailer, change fluid every 50,000 miles. Operators of cars in commercial use (such as taxi-cab or limousine service) where the engine idles for long periods, should change fluid every 50,000 miles.

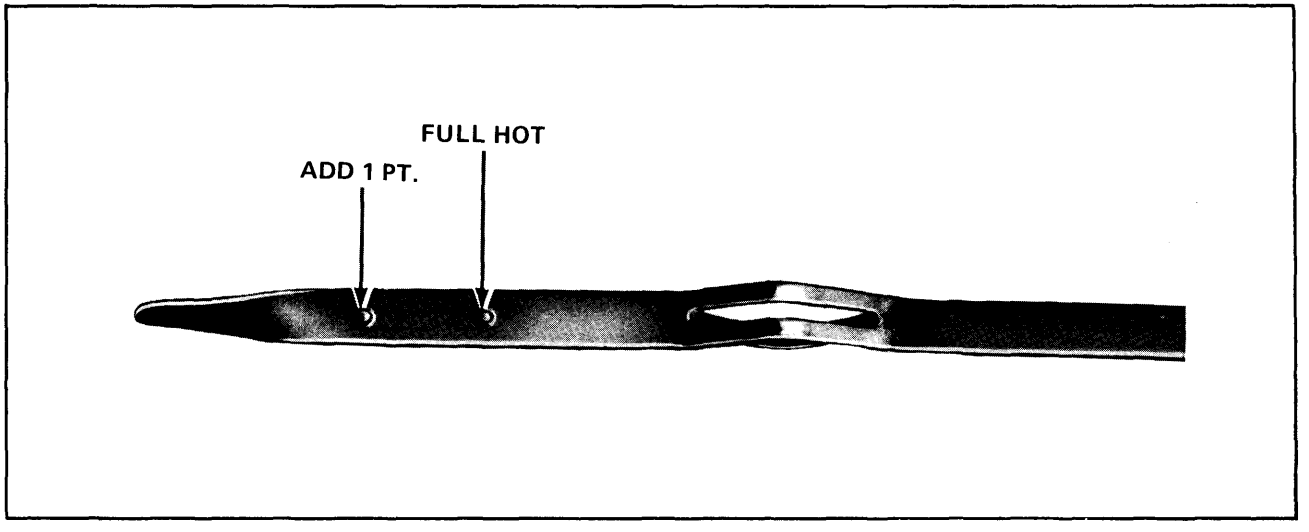


Fig. 7-15 Transmission Oil Level

BACK TO INDEX

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In any case of a major transmission malfunction, the filter assembly must be replaced. In addition, the oil cooler and cooler lines should be flushed, before adding new fluid.

b. Checking and Adding Fluid

Automatic transmissions are frequently overfilled because the fluid level is checked when the fluid is cold and the dipstick indicates fluid should be added. However, the low reading is normal since the level will rise as the fluid temperature increases. A level change of over 3/4 inch will occur as fluid temperature rises from 60° to 180° (Celsius 16 to 82).

Overfilling can cause foaming and loss of fluid through the vent. Slippage and transmission failure can result.

Fluid level too low can cause slipping, particularly, when the transmission is cold or the car is on a hill.

Check the transmission fluid level with the engine running, the shift lever in Park, and the car level.

(NOTE: If the vehicle has recently been operated for an extended period at high speed or in city traffic in hot weather or the vehicle is being used to pull a trailer, an accurate fluid level cannot be determined until the fluid has cooled down – usually about 30 minutes after the vehicle has been parked.)

Remove the dipstick and touch the transmission end of the dipstick cautiously to find out if the fluid is cool, warm or hot.

Wipe it clean and re-insert until cap seats. Remove dipstick and note reading.

If the fluid feels cool, about room temperature (65° to 85°) (Celsius 18 to 29) the level should be 1/8 to 3/8 inch below the ADD mark.

If it feels warm the level should be close to the ADD mark (either above or below).

If it feels hot (cannot be held comfortably) the level should be between the ADD and FULL marks.

(NOTE: DO NOT OVERFILL. It takes only one pint to raise level from ADD to FULL with a hot transmission.)

c. Draining Bottom Pan and Replacing Intake Pipe and Filter Assembly

1. Remove dipstick from filler tube and insert a length of hose secured to a suction gun down the filler tube. Remove 2 quarts of transmission fluid so that bottom pan will not overflow when removed.
2. Raise car on hoist or place on jack stands and provide container to collect draining oil.
3. Remove bottom pan and gasket. Discard gasket.
4. Drain fluid from bottom pan. Clean pan with solvent and dry thoroughly with clean compressed air.
5. Remove filter retainer bolt.
6. Remove intake pipe and filter assembly. Remove and discard intake pipe O-ring and filter.
7. Install new intake pipe O-ring onto pipe and install intake pipe into filter assembly.
8. Install intake pipe and filter assembly into case bore.
9. Install filter retainer bolt
10. Install new gasket on bottom pan and install bottom pan. Tighten bottom pan attaching screws to 12 foot-pounds.
11. Lower car and add 4 quarts of transmission fluid through filler tube when replacing intake pipe O-ring seal and filter assembly. When draining bottom pan only add 2 quarts of transmission fluid.
12. Operate engine at 800 rpm for approximately 1-1/2 minutes with selector lever in park "P" position.
13. Reduce engine speed to slow idle and check fluid level. Add fluid, if necessary, to bring to proper level, Fig. 7-15.

d. Adding Fluid to Fill Dry Transmission and Converter Assembly

The fluid capacity of the Turbo Hydra-matic transmission and converter assembly is approximately 25 pints but correct level is determined by mark on dipstick rather than by amount added. It is important that proper level be maintained. In cases of transmission overhaul, when a complete fill is required, including converter, proceed as follows:

1. Add 8 quarts of transmission fluid through filler tube.
2. Operate engine at 800 rpm for approximately 1-1/2 minutes with selector lever in park "P" position.
3. Reduce engine speed to slow idle.
4. Check fluid level and add additional fluid, if necessary, to bring to proper level, Fig. 7-15.

6. Towing Instructions

Refer to the General Motors Passenger Car and Light Truck Towing Instructions Manual.

7. Units That Can Be Removed With Transmission in Car

The following units can be removed from the transmission without removing transmission from car.

BACK TO INDEX
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While the detailed procedure for removing each of the units, other than the extension housing and oil seal, and pressure regulator valve, is not outlined separately, the procedures covered under the transmission disassembly and assembly notes will apply.

a. Extension Housing
Removal - Note 9a
Installation - Note 9a
Oil Seal Replacement - Note 8

b. Pressure Regulator Valve
Removal - Note 10a
Installation - Note 10a

c. Vacuum Modulator and Valve
Removal - Note 14
Installation - Note 53

d. Governor Assembly
Removal - Note 15
Disassembly - Note 34
Installation - Note 54

e. Speedometer Driven Gear Assembly or Trackmaster Speed Sensor
Removal - Note 16
Disassembly - Note 35
Installation - Note 55

f. Intake Pipe and Filter Assembly and Bottom Pan
Removal - Note 17
Installation - Note 56 or Note 5C.

g. Control Valve Assembly, Governor Pipes, and Detent Spring and Roller Assembly
Removal - Note 18
Disassembly - Note 36
Installation - Note 52

h. Rear Servo Assembly
Removal - Note 19
Disassembly - Note 37
Installation - Note 51

i. Downshift Solenoid, Solenoid Connector, Control Valve Spacer and Gaskets, Check Balls, and Front Servo Assembly
Removal - Note 21
Front Servo Disassembly - Note 38
Installation - Note 50

j. Detent Lever, Manual Shaft, and Parking Linkage
Removal - Note 25
Installation - Note 48

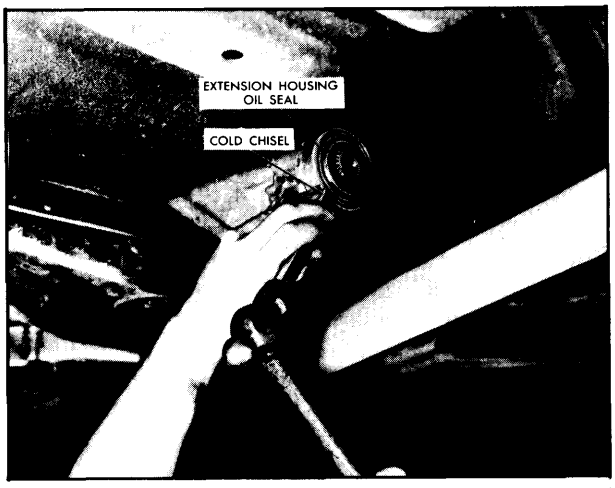


Fig. 7-16 Removing Extension Housing Oil Seal

8. Extension Housing Oil Seal Replacement (Transmission in Car)

1. Raise car on hoist or place on jack stands. Inspect leak to determine if cause is O-ring or housing seal.
2. Remove propeller shaft assembly as described in Section 4. Note 29.
3. Use hammer to drive chisel under lip of oil seal and pry seal out of housing, Fig. 7-16.
4. Install new extension housing oil seals onto Oil Seal Installer, J-21359.
5. Apply sealer supplied with new seal to outside of seal and install seal in extension housing using Oil Seal Installer, J-21359, Fig. 7-17.
6. Install propeller shaft assembly as described in Section 4. Note 29.
7. Lower car to floor and add fluid to transmission as required.

9. Extension Housing Removal and Installation (Transmission in Car)

a. Removal

1. Raise car on hoist or place on jack stands. Provide container to catch oil.
2. Remove propeller shaft assembly as described in Section 4, Note 29.
3. Remove rear engine mount to extension housing attaching screws.
4. Place jack under bottom oil pan. Use a block of wood to prevent damage to pan and raise transmission to lift extension housing off rear engine mount.
5. Remove six extension housing attaching screws and slide extension housing rearward and downward to remove from car. Make certain that output shaft splines do not come in contact with extension housing oil seal, as splines could damage seal lip.
6. Remove and discard O-ring from output shaft.

BACK TO INDEX

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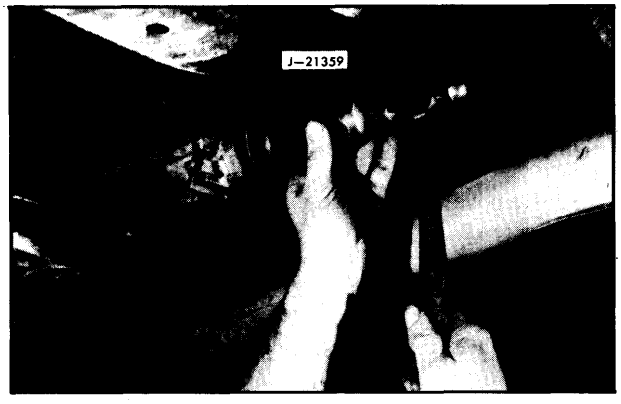


Fig. 7-17 Installing Extension Housing Oil Seal

b. Installation

1. Install gasket on extension housing.
2. Install new O-ring on output shaft and grease O-ring and splines with specified lubricant.
3. Carefully install extension housing over output shaft and against transmission case. Do not permit output shaft to contact oil seal as splines could damage seal lip.
4. Install six extension housing to case attaching screws, tightening screws to 23 foot-pounds.
5. Lower transmission onto rear engine mount.
6. Install two rear engine mount to extension housing screws. Tighten screws to 55 foot-pounds.
7. Remove jack from bottom of oil pan.
8. Install propeller shaft assembly as described in Section 4, Note 29.
9. Lower car to floor and add fluid to transmission as required.

10. Pressure Regulator Valve Removal and Installation (Transmission in Car)

a. Removal

CAUTION: The solid type pressure regulator valve does not contain oil holes and an orifice cup plug like the previous type pressure regulator valve. The solid style valve must only be used in the pump cover with the squared off pressure regulator boss, (pressure boost bushing end). See Fig. 7-19. The previous pressure regulator valve with the oil holes and orifice cup plug will be used to service either type pump cover.

1. Raise car on hoist or place on jack stands. Provide container to catch oil.
2. Remove bottom pan and gasket. Drain oil.
3. Remove the filter retaining bolt and lift out pump intake pipe and filter assembly.
4. Remove and discard intake pipe O-ring and bottom pan gasket.
5. Using a screwdriver, steel rod or Tool J-24684 compress regulator boost valve bushing against pressure regulator spring, Fig. 7-18.

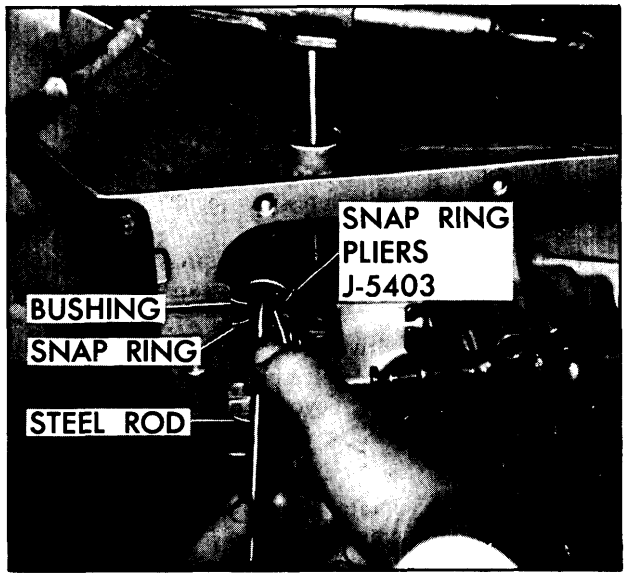


Fig. 7-18 Removing and Installing Pressure Regulator Valve

WARNING: PRESSURE REGULATOR SPRING IS TIGHTLY COMPRESSED AND WILL FORCE VALVE BUSHING OUT OF BORE WHEN SNAP RING IS REMOVED IF VALVE BUSHING IS NOT HELD SECURELY.

6. Continue to exert pressure on valve bushing and remove snap ring, using Snap Ring Pliers, J-5403 (#21). Gradually release pressure on valve bushing until all spring force is exhausted.
7. Carefully remove regulator boost valve bushing and valve, and pressure regulator spring. Be careful not to drop parts, as they will fall out if they are not held.
8. Remove pressure regulator valve and spring retainer. Remove spacers if present. Be careful not to drop pressure regulator valve when removing it from bore.

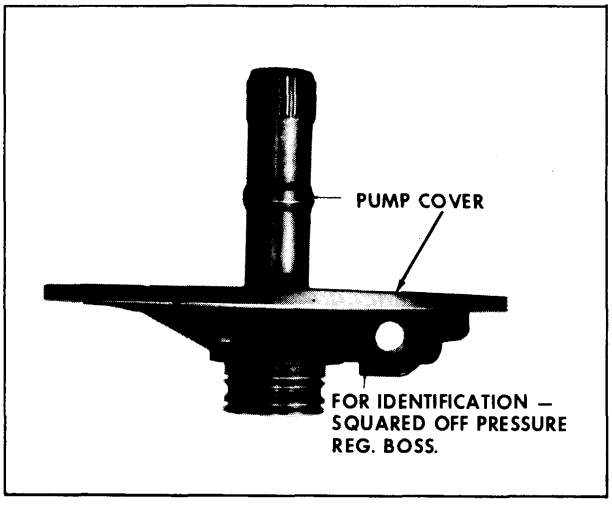


Fig. 7-19 Solid Type Pressure Regulator Valve

BACK TO INDEX

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b. Installation

1. Install spring retainer on pressure regulator spring. Also install spacers if previously removed.
2. Install pressure regulator valve on spring, stem end first.
3. Install boost valve into bushing, stem end out, and stack parts so that pressure regulator spring is against valve bushing.
4. Install complete assembly into pressure regulator valve bore, being careful not to drop parts during installation.
5. Using a screwdriver, steel rod or tool J-24684 compress regulator boost valve bushing against pressure regulator spring until it is beyond snap ring groove, and install snap ring using Snap Ring Pliers, J-5403 (#21), Fig. 7-18.

(NOTE: To facilitate installation of snap ring, encircle it around screwdriver or steel rod, compress tangs with snap ring pliers, and slide snap ring upward into ring groove in valve bore.)

6. Install new intake pipe O-ring onto intake pipe and install intake pipe and filter assembly into transmission case bore, retaining filter with retainer bolt.
7. Install new gasket on bottom pan and install bottom pan.
8. Install thirteen bottom pan attaching screws. Tighten screws to 12 foot-pounds.
9. Lower car to floor and add fluid to transmission as required.

11. Transmission Removal and Installation

a. Removal

1. Disconnect negative battery cable.
2. Raise car on hoist.
3. Disconnect transmission linkage by removing one nut from shaft on left side of transmission.
4. Remove speedometer drive cable and disconnect trackmaster electrical harness, if so equipped. Disconnect downshift solenoid connector at case.
5. Disconnect oil cooler pipes at transmission using an open end wrench to hold fitting and a tubing wrench or a crowfoot adapter to remove tube nut. Cap pipes and plug connector holes in transmission. Position oil cooler pipes out of way.
6. Disconnect vacuum pipe hose from vacuum modulator and position vacuum pipe out of way.
7. Remove two screws that hold starter motor to engine block. Remove starter motor bracket and slide starter forward.
8. Remove propeller shaft as described in Section 4, Note 29.
9. Remove lower flywheel housing cover.
10. Remove three converter to flywheel attaching bolts.

CAUTION: This is done by inserting a heavy screwdriver in open slot under one of the weld nuts on the converter, and rotating converter and flywheel until bolts can be reached for removal. Do not pry on flywheel ring gear or transmission case to rotate converter, as flywheel or case might be damaged. A bolt in the end of the crankshaft balancer can also be used to rotate the flywheel.

11. Place jack or other suitable device under rear of engine.
12. Remove two rear engine mount to extension housing screws.
13. Position transmission jack under transmission and raise it just enough to take the load off rear engine support.
14. Remove four bolts, two each side, from rear engine support and swivel support out of position. Allow support to hang by parking brake cable.
15. Remove six transmission case to engine attaching screws. It may be necessary to lower engine and transmission slightly to gain access to upper attaching screws.
16. Move transmission toward rear of car, disengaging transmission case from locating dowels on engine, install Converter Holding Clamp, J-21366, on front of transmission case, Fig. 7-20 and lower transmission from car.

CAUTION: Converter holding clamp must be used when removing transmission, otherwise converter can fall out when transmission is removed.

17. Remove Converter Holding Clamp from transmission case and remove converter.

CAUTION: Converter with oil weighs approximately 50 pounds. Be careful not to drop or damage converter when removing it.

b. Installation

1. Install converter on turbine shaft making certain that converter drive hub is fully engaged with pump gear tangs, and install Converter Holding Clamp, J-21366, on front of transmission case, Fig. 7-20.

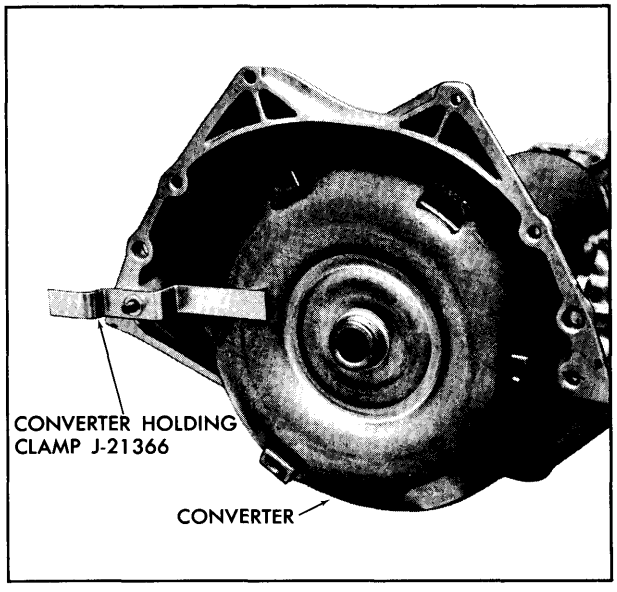


Fig. 7-20 Installing Converter Holding Clamp

BACK TO INDEX
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2. Place transmission on transmission jack and carefully raise into position. Remove Converter Holding Clamp.

3. Align front of transmission case with engine and dowel holes in transmission case with dowels on engine. Install six transmission case to engine attaching screws, tighten screws to 35 foot-pounds.

CAUTION: The procedure for attaching the converter to the flywheel as described in Steps 4 through 6 must be strictly followed. Any deviation from this procedure may result in improper installation and damage to flywheel and transmission.

4. Rotate converter until two of the three weld nuts on converter line up with two bolt holes in flywheel. Make certain converter rotates freely in this position and is not cocked and that pilot in center of converter is properly seated in crankshaft.

5. Install two flywheel to converter attaching bolts through accessible bolt holes in flywheel and tighten finger tight. Bolts must not be tightened at this time to assure proper alignment of converter.

6. Insert screwdriver under converter weld nut, rotate converter and install third attaching bolt. Tighten all bolts to 30 foot-pounds.

7. Install lower flywheel housing cover screws tightening screws to 5 foot-pounds.

8. Position starter motor to engine block and install two screws, tightening screws to 46 foot-pounds. Starter harness heat shield and starter ground strap should be installed under outboard screw. Route starter harness inside heat shield.

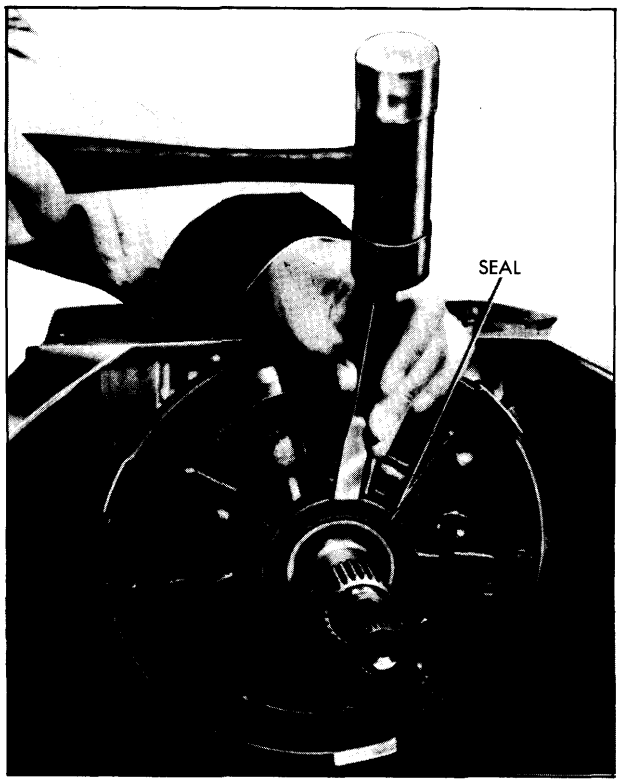


Fig. 7-21 Removing Pump Oil Seal

9. Install starter motor front bracket, tightening screws to 12 foot-pounds.

10. Raise engine and transmission above normal height and swivel rear engine support into position. Install two bolts on each side, tighten bolts to 30 foot-pounds.

11. Lower transmission carefully and install two rear engine mount to extension housing screws. Tighten screws to 55 foot-pounds.

12. Remove jacks.

13. Install speedometer cable and downshift solenoid electrical harness to transmission case. Connect trackmaster harness if vehicle is so equipped.

14. Install transmission linkage to shaft and secure with one nut.

15. Install vacuum hose on modulator, making sure modulator pipe is fully engaged with modulator.

16. Clean ends of oil cooler pipes with solvent and connect pipes to transmission using an open end wrench to hold fitting and a tubing wrench or a crowfoot adapter to tighten tube nut.

17. Install propeller shaft as described in Section 4. Note 29.

18. Lower car and connect negative battery cable.

19. Add fluid to transmission as required.

20. Check operation of manual linkage. Adjust, if necessary as described in Note 3.

12. Pump Oil Seal Replacement

1. Remove transmission assembly from car as described in Note 11a.

2. Use hammer to drive chisel under lip of oil seal and pry seal out of pump body, Fig. 7-21.

3. Before installing new seal, make certain bore is free from foreign material and that garter spring on seal is correctly positioned. Also check finish of converter neck and bearing surface in pump body.

(NOTE: Use a non-hardening sealer on outside of seal body before installing seal.)

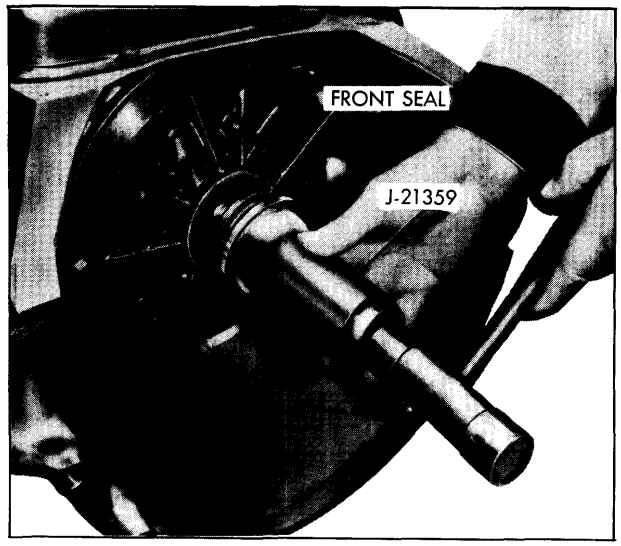


Fig. 7-22 Installing Pump Oil Seal

BACK TO INDEX

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4. Install new seal in pump body using Pump Oil Seal Installer, J-21359, Fig. 7-22.

5. Install transmission assembly in car as described in Note 11b.

MAJOR TRANSMISSION COMPONENTS—REMOVAL

13. Converter

1. Remove transmission from car as described in Note 11a and remove converter from transmission.
2. Perform visual inspection as follows:
a. Inspect converter for visual signs of damage.
b. Inspect for wrong converter.
c. Inspect neck of converter for wear.
d. Inspect pump drive slots for signs of excessive wear.
3. Insert valve, part of Converter Leak Test Fixture, J-21369-01, in neck of converter and back-off large hex nut.
4. Install leak test fixture band crosswise on converter so that slotted plate fits around valve and under nut. Fig. 7-23. Tighten nut to expand O-ring and secure a good seal.
5. Apply compressed air with a service air hose until approximately 80 to 100 psi air pressure is obtained.

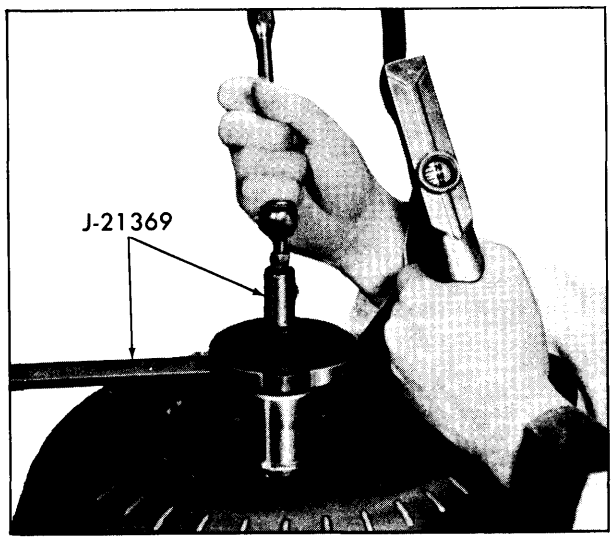


Fig. 7-23 Leak Checking Converter

6. Immerse assembly in water, noting any sign of bubbles that would indicate a leak.
7. Depress valve stem to release air pressure in converter and then remove leak test fixture band and valve.

WARNING: ALWAYS RELEASE AIR PRESSURE BEFORE REMOVING VALVE, AS A DEFINITE HAZARD EXISTS SHOULD VALVE BLOW OUT DURING REMOVAL.

8. Thoroughly dry converter and install converter in transmission as follows:
a. Place transmission in Holding Fixture, J-8763-01 and install Holding Fixture in Holding Fixture Base, J-3289-21, so that transmission is positioned vertically with pump end up.
b. Carefully position converter on turbine shaft, making certain converter is properly aligned. Long screws or eyebolts can be threaded into the weld nuts on the converter and used as handles.
c. Rotate converter until the shafts are piloted and the converter lugs are indexed in the pump gear.
d. If difficulty is experienced in alignment, tap on outer diameter of converter with plastic-headed hammer, while turning converter.
9. Install transmission as described in Note 11b.

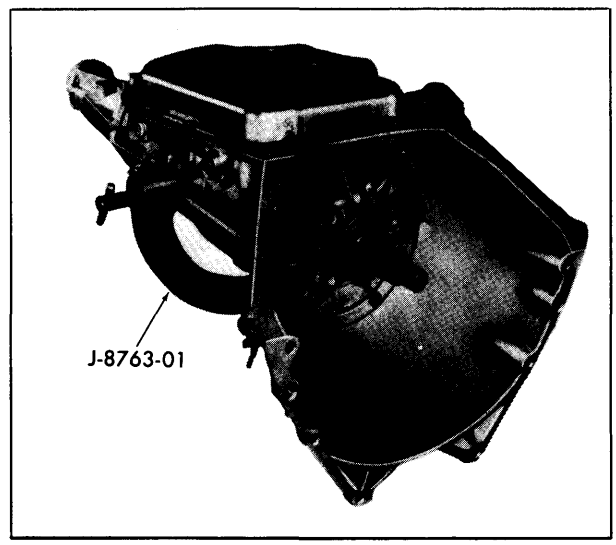


Fig. 7-24 Transmission in Holding Fixture

(NOTE: On the following operations when the transmission is out of car remove converter from transmission and install Holding Fixture, J-8763-02, on transmission so that vacuum modulator will be located on side of Holding Fixture nearest the bench. Install fixture and transmission into Holding Fixture Base, J-3289-21, with bottom pan facing up, Fig. 7-24, and install lock pin in base. Provide container to catch any oil that may drain from transmission.)

14. Remove Vacuum Modulator and Valve

(NOTE: Unit may be removed without removing transmission or bottom pan.)

1. Remove vacuum hose from modulator.
2. Remove vacuum modulator attaching screw and retainer from transmission case.

BACK TO INDEX

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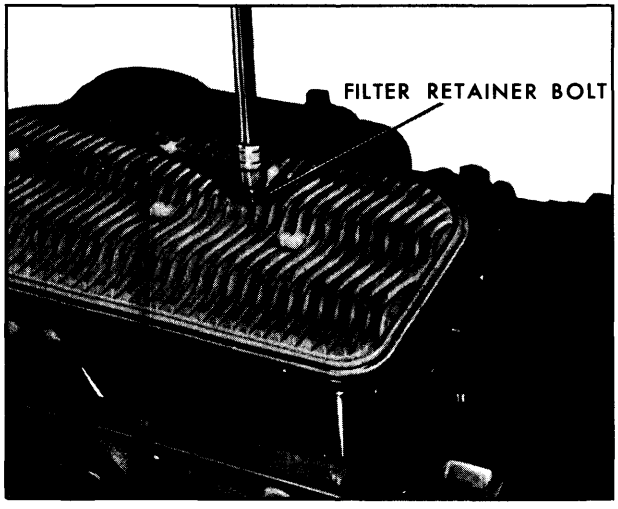


Fig. 7-25 Removing Filter Retaining Bolt

3. Remove modulator assembly and O-ring from case. Discard O-ring.
4. Remove modulator valve from transmission case.

15. Remove Governor Assembly

(NOTE: Unit may be removed without removing transmission or bottom pan.)

1. Remove four attaching screws, governor cover, and gasket. Discard gasket.
2. Remove two bolts attaching transmission extension housing to cross member.
3. Move rear of transmission sideways enough to allow clearance for governor removal.
4. Remove governor assembly.

16. Remove Speedometer Driven Gear Assembly and Trackmaster Speed Sensor

(NOTE: Unit may be removed without removing transmission or bottom pan, after removing speedometer cable from driven gear assembly.)

1. Remove attaching screw and retainer from left side of case. Apply slight pressure to remove unit and speedometer driven gear.

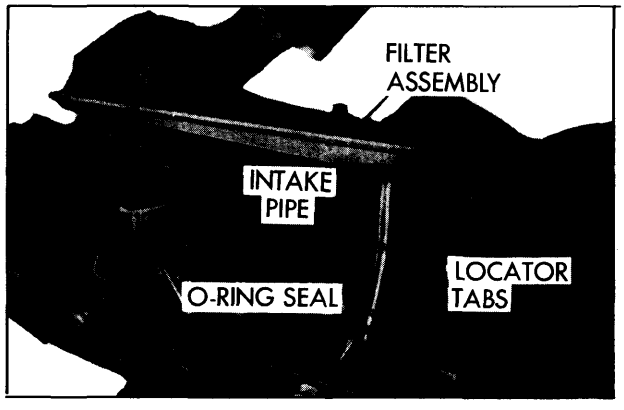


Fig. 7-26 Removing Intake Pipe and Filter Assembly

17. Remove Intake Pipe and Filter Assembly and Bottom Pan

(NOTE: Unit may be removed with transmission in car. In cases of transmission malfunction, filter must be replaced.)

1. Remove bottom pan attaching screws.
2. Remove bottom pan and gasket. Discard gasket. Drain oil from pan if transmission is in car.
3. Remove filter retainer bolt, Fig. 7-25.
4. Lift out pump intake pipe and filter assembly, Fig. 7-26.
5. Remove intake pipe from filter and discard filter.
6. Remove and discard intake pipe O-ring.

18. Remove Control Valve Assembly, Governor Pipes, and Detent Spring and Roller Assembly

(NOTE: Units may be removed with transmission in car, after removing bottom pan.)

1. Remove attaching screw and remove detent spring and roller assembly.
2. Remove ten remaining control valve assembly attaching screws. Do not remove solenoid attaching screws at this time.
3. Remove control valve assembly with the two governor pipes attached, Fig. 7-27.

CAUTION: Do not allow manual valve to fall out of its bore in control valve assembly. If transmission is in car be careful not to drop front servo group which may drop out as control valve assembly is removed.

4. Remove governor screen assembly from end of governor feed pipe or governor feed pipe hole in case. Fig. 7-28. Clean screen in clean solvent and air dry.

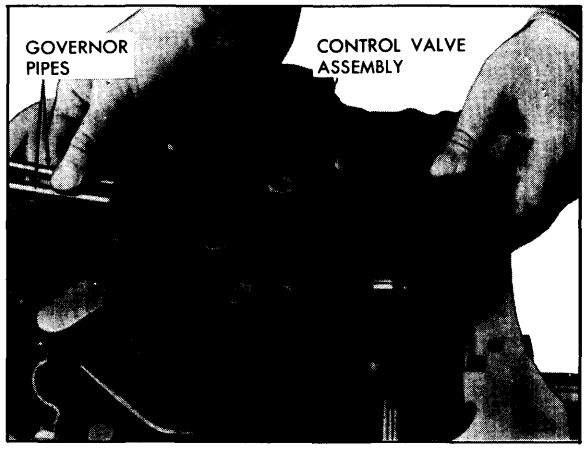


Fig. 7-27 Removing Control Valve Assembly

BACK TO INDEX

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5. Remove governor pipes from valve body. Governor pipes are interchangeable and need not be identified.

19. Remove Rear Servo Assembly

(NOTE: Unit may be removed with transmission in car after removing bottom pan and allowing fluid to drain. Remove control valve assembly, and governor pipes (Note 18.)

1. Remove six rear servo cover attaching screws, servo cover, and gasket. Discard gasket.
2. Remove rear servo assembly from transmission case, Fig. 7-29.
3. Remove servo accumulator spring.
4. Make band apply pin selection check (Note 20) to determine proper size pin to use at time rear servo is assembled.

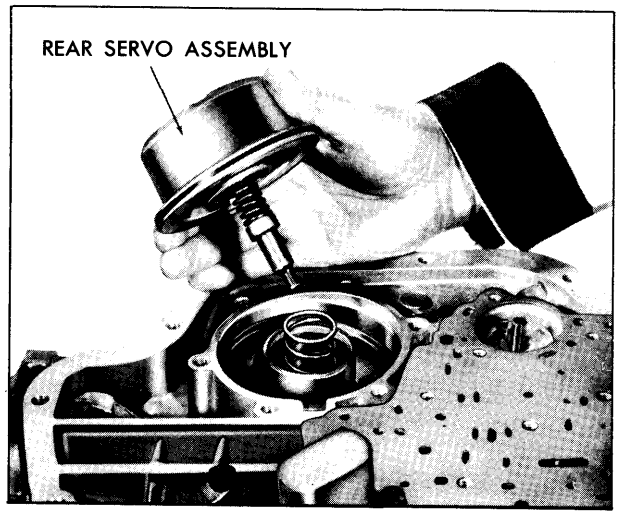


Fig. 7-29 Removing Rear Servo Assembly

20. Band Apply Pin Selection Check

(NOTE: Check may be made with transmission in car. Remove bottom pan and allow fluid to drain. Remove control valve assembly, governor pipes (Note 18 and rear servo Note 19.)

1. Position Band Apply Pin Selector Gage, J-21370-6, on transmission case over rear servo bore, with hex nut on side of gage facing toward parking brake linkage, and smaller diameter end of Gage Pin, J-21370-5, in servo pin bore, Fig. 7-30.

2. Secure gage with two 5/16-18 x 1 inch screws, tightening screws to 18 foot-pounds. Make certain that stepped gage pin is free to move up and down in both tool and servo pin bore. Stepped side of pin must face front of transmission case.

Band apply pins are available in three sizes as shown in the following chart:

IDENTIFICATION	LENGTH
Three Rings	Long
Two Rings	Medium
One Ring	Short

Identification ring is located on band lug end of pin. Selecting the proper pin is equivalent to adjusting band.

3. To determine proper size pin to use, apply 25 foot-pounds torque on hex nut on side of gage, Fig. 7-30. This will cause lever on top of gage to depress stepped gage pin into servo pin bore, simulating actual operating conditions. Note relation of steps on gage pin and machined surface on top of gage. Determine proper size pin as follows:

a. If machined surface on top of gage is even with or above upper step on gage pin, long size pin (three rings) is required.

b. If machined surface on top of gage is between

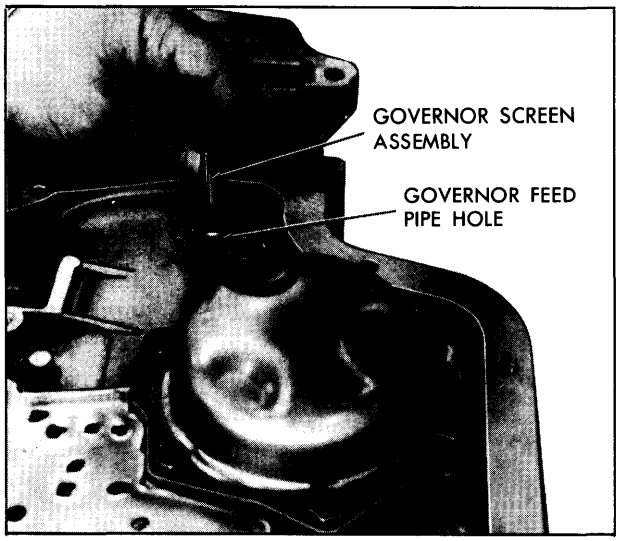


Fig. 7-28 Removing Governor Screen Assembly

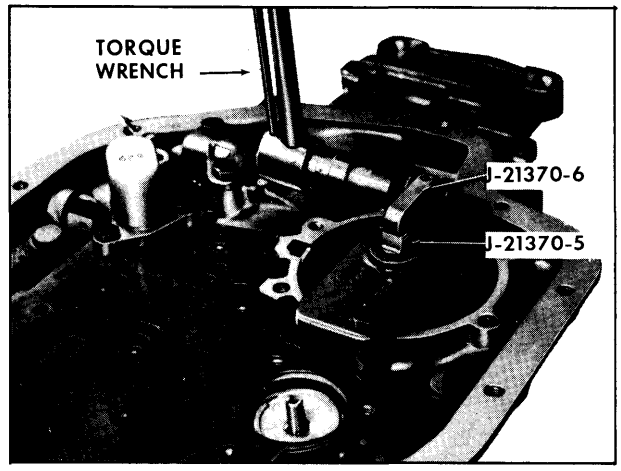


Fig. 7-30 Band Apply Pin Selection Check

BACK TO INDEX

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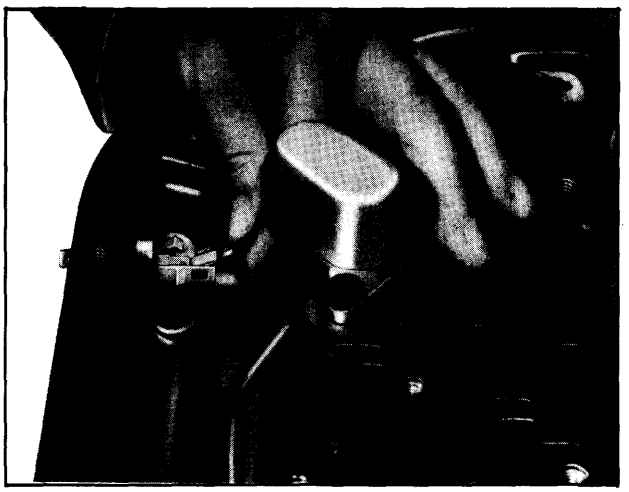


Fig. 7-31 Removing Wire From Electrical Connector

upper and lower steps on gage pin, medium size pin (two rings) is required..

c. If machined surface on top of gage is even with or below step on gage pin, short size pin (one ring) is required.

4. If new pin is required, make note of pin size required, and remove gage from transmission case.

21. Remove Detent Solenoid, Solenoid Connector, Control Valve Spacer, Gaskets, Check Balls, and Front Servo Assembly

(NOTE: Units may be removed with transmission in car. Remove bottom pan and drain transmission fluid).

To remove control valve spacer, gasket, check balls, and front servo, remove control valve assembly and governor pipes Note 18.

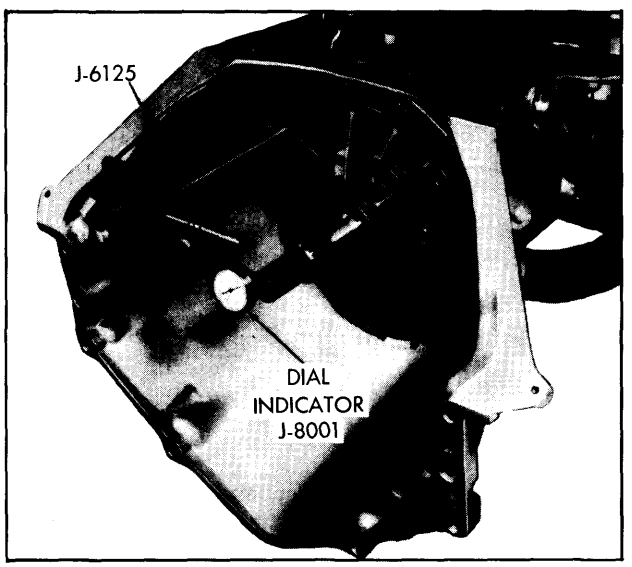


Fig. 7-32 Front Unit End Play Check



Fig. 7-33 Removing Pump Assembly

1. Disconnect detent solenoid wire from electrical connector terminal, see Fig. 7-31.

2. Compress tabs on case connector and remove connector and O-ring from case. Discard O-ring.

3. Remove two detent solenoid attaching screws and remove solenoid assembly and gasket.

4. Remove control valve spacer plate from case.

(NOTE: If operation is being performed on car, lower control valve spacer plate in a level plane so that check balls don't fall out. Then remove check balls from spacer plate.)

5. Remove five check balls from cored passages in transmission case.

6. Lift front servo piston, retainer ring, pin, spring retainer, and spring out of transmission case.

22. Remove Rear Oil Seal and Extension Housing

(NOTE: Units may be removed with transmission in car. See Notes 8 and 9.)

1. If required, use hammer to drive chisel under oil seal flange and pry seal out of extension housing.

2. Remove six extension housing attaching screws and remove extension housing.

3. Remove and discard gasket from extension housing.

23. Front Unit End Play Checking Procedure

(NOTE: Transmission must be removed from car Note 11a.)

BACK TO INDEX

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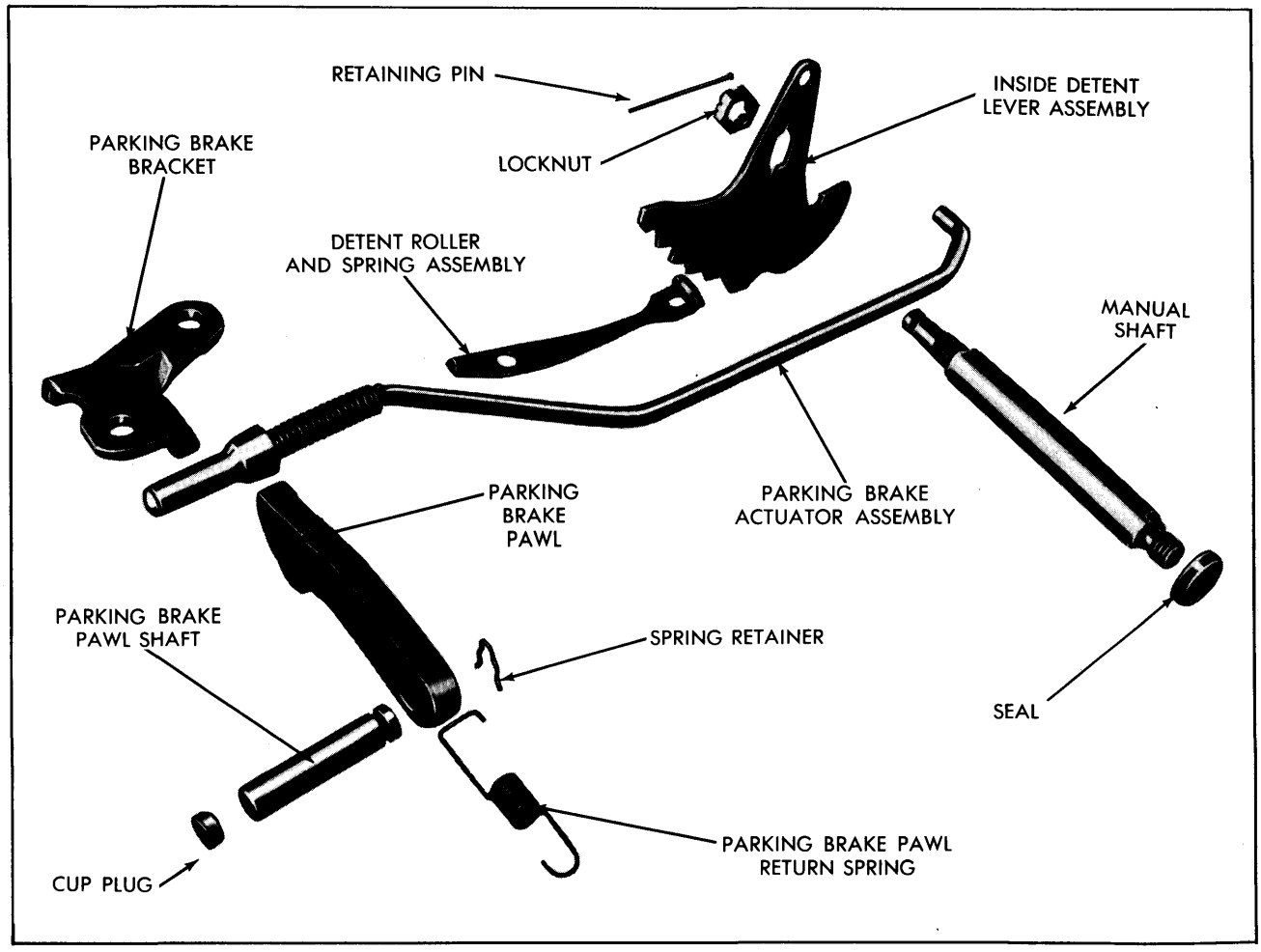


Fig. 7-34 Manual and Parking Linkage

1. Remove one oil pump attaching screw and rubber-coated washer at either 10 o'clock or 5 o'clock position.

2. Install Slide Hammer Bolt, J-6125-1, and Adapter, J-6125-2, in screw hole where attaching screw was removed.

3. Mount Dial Indicator, J-8001-02, on slide hammer bolt and index indicator to register with flat surface on end of turbine shaft.

4. Hold output shaft forward while pushing turbine shaft rearward to its stop.

5. Set dial indicator to zero.

6. Pull turbine shaft forward, Fig. 7-32.

Note resulting travel or end play for selection of washer for use at time of transmission assembly. End play should be .003 inch- .024 inch. The selective washer controlling this end play is the washer located between pump cover and forward clutch housing. If more or less washer thickness is required to bring end play within specifications, select proper washer from the following chart.

THICKNESS (INCH	COLOR
.060 - .064	Yellow
.071 - .075	Blue
.082 - .086	Red
.093 - .097	Brown
.104 - .108	Green
.115 - .119	Black
.126 - .130	Purple

(NOTE: An oil-soaked washer may tend to discolor. If necessary, measure washer for thickness.)

7. Remove dial indicator. If oil pump is to be removed, do not remove slide hammer assembly at this time.

24. Remove Oil Pump

(NOTE: For removing oil pump only, transmission must be removed from car Note 11a.)

1. If not done previously, perform the following steps:

BACK TO INDEX

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a. Remove one oil pump attaching screw and rubber-coated washer at either 10 o'clock or 5 o'clock position.

b. Install Slide Hammer Bolt, J-6125-1, and Adapter, J-6125-2, in screw hole where attaching screw was removed, Fig. 7-33.

2. Remove other pump attaching screws and washers.

3. Install Slide Hammer Bolt, J-6125-1, and Adapter, J-6125-2, into other threaded hole at 10 o'clock or 5 o'clock position in pump body and drive outward with slide hammers to remove pump assembly from transmission case, Fig. 7-33.

CAUTION: Drive outward in unison on both slide hammer assemblies to prevent cocking pump assembly in case.

4. Remove slide hammer assemblies from pump.

5. Remove and discard pump square cut O-ring and gasket.

25. Remove Detent Lever, Manual Shaft, and Parking Linkage (Fig. 7-34)

(NOTE: Units may be removed with transmission in car. Drain transmission fluid by removing bottom pan. Remove manual linkage from manual lever and remove detent spring and roller assembly from control valve assembly.)

1. Remove pin securing manual shaft to case.

(NOTE: If procedure is being performed on car, bend pin to remove it.)

2. Loosen locknut securing inside detent lever to manual shaft.

3. Pry or work inside detent lever loose from manual shaft and remove locknut.

4. Remove manual shaft, parking actuator rod and detent lever from case. Inspect manual shaft lip seal as required.

5. Remove parking brake bracket attaching screws and remove bracket.

6. Remove parking pawl return spring.

(NOTE: The following steps are to be completed only if one or more of the parts involved require replacement.)

7. Remove spring retainer from parking pawl shaft.

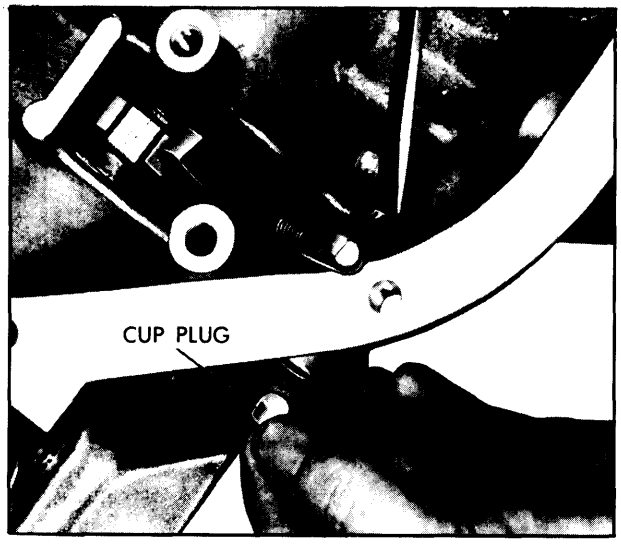


Fig. 7-35 Removing Cup Plug

8. Remove parking brake pawl shaft cup plug by placing screwdriver between parking pawl shaft and case rib and prying outward, Fig. 7-35.

9. Remove parking pawl shaft and parking pawl.

26. Remove Turbine Shaft, Forward Clutch Housing, Direct Clutch Assembly, Sun Gear Shaft, and Front Band

(NOTE: Transmission must be removed from car, Note 11a. Requires removal of oil pump, Note 24.

1. Remove turbine shaft and forward clutch assembly from transmission, Fig. 7-36.

2. Remove forward clutch hub to direct clutch housing thrust washer if it did not come out with forward clutch assembly.

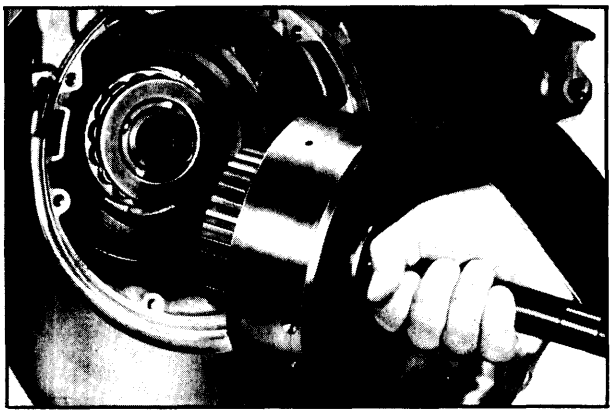


Fig. 7-36 Removing Forward Clutch Assembly

BACK TO INDEX

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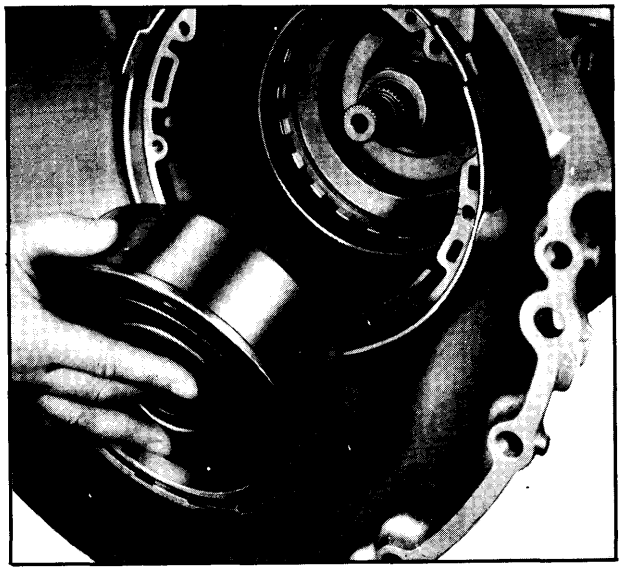


Fig. 7-37 Removing Direct Clutch and Intermediate Roller Assembly

3. Remove direct clutch and intermediate roller assembly, Fig. 7-37. Sun gear shaft may come out with direct clutch assembly.

4. Remove sun gear shaft if not previously removed. See Fig. 7-38.

5. Remove front band assembly.

(NOTE: Check rear unit end play at this time. Proceed as follows:)

27. Rear Unit End Play Checking Procedure

(NOTE: Transmission must be removed from car, Note 11a. Requires removal of extension housing.)

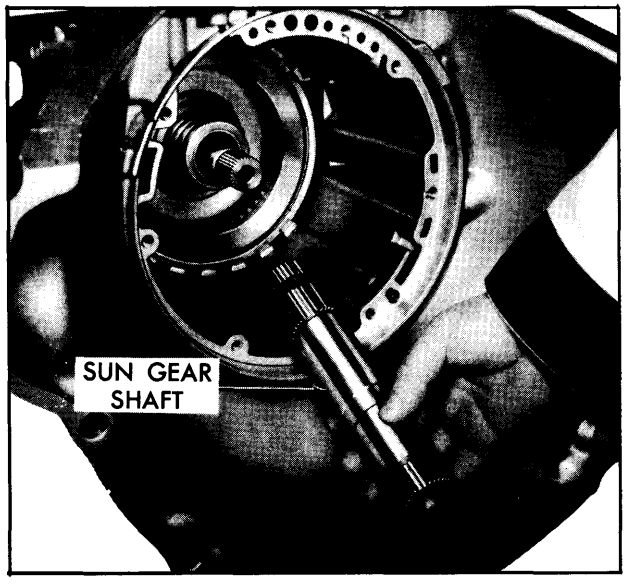


Fig. 7-38 Removing Sun Gear Shaft

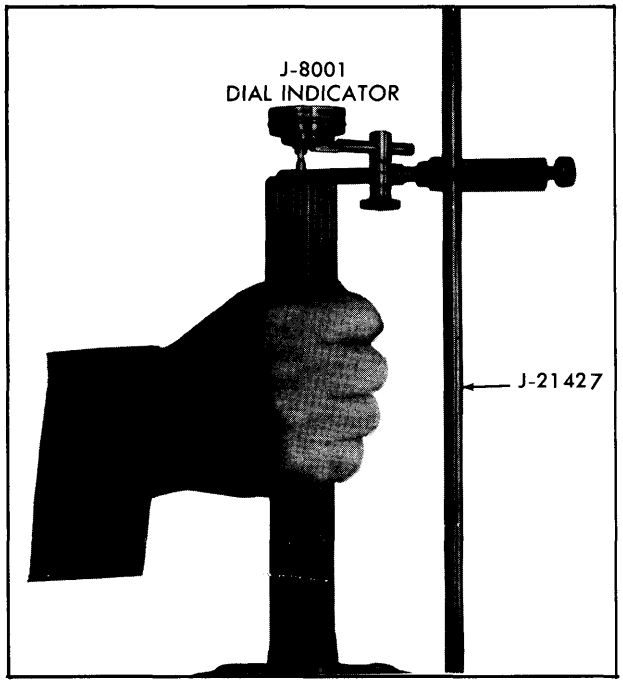


Fig. 7-39 Checking Rear Unit End Play

1. Install Speedometer Puller Bolt, J-21797, in one of the bolt holes on end of transmission case.

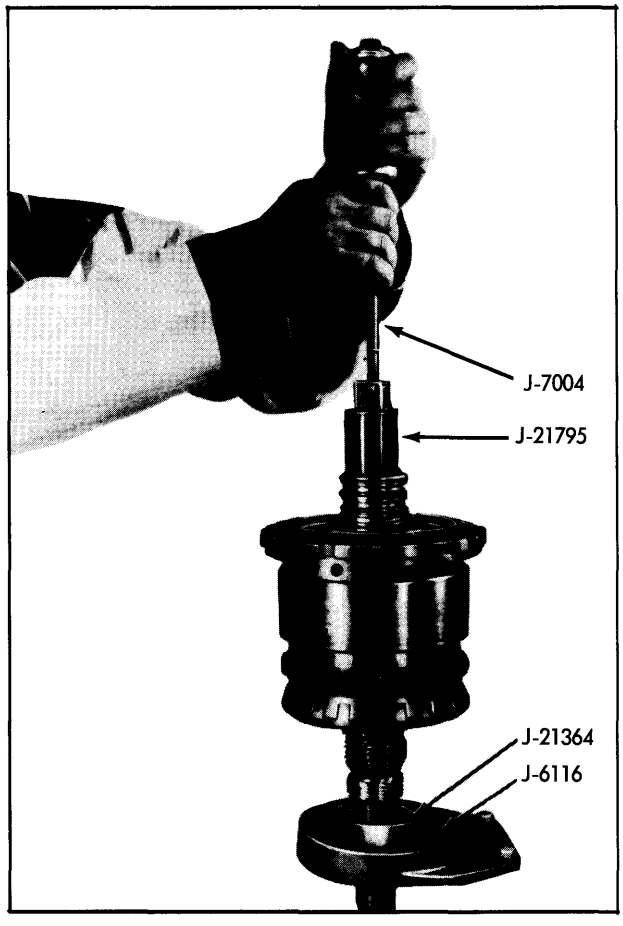


Fig. 7-40 Gear Unit in Holding Fixture

BACK TO INDEX

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2. Mount Dial Indicator, J-8001, on Bolt, J-21797, and index indicator to register with flat surface on end of output shaft, Fig. 7-39.

3. Set dial indicator to zero.

4. Move output shaft in and out. Note resulting travel or end play for selection of washer for use at time of transmission assembly. End play should be .007 inch - .019 inch.

The selective washer controlling this end play is the steel washer with the three tabs, located between thrust washer and rear face of transmission case. Notches and/or numerals on the tabs serve to identify washer thickness.

If a different washer thickness is required to bring end play within specifications, it can be selected from the following chart. The table will show identification notches numerals or both.

THICKNESS (INCH)	IDENTIFICATION NOTCH AND/OR NUMERAL	
.074 - .078	None	1
.082 - .086	On Side of 1 Tab	2
.090 - .094	On Side of 2 Tabs	3
.098 - .102	On End of 1 Tab	4
.106 - .110	On End of 2 Tabs	5
.114 - .118	On End of 3 Tabs	6

28. Remove Remaining Components

(NOTE: Transmission must be removed from car Note 11a. Requires removal of bottom pan, control valve assembly and governor pipes Note 18, rear servo assembly Note 19, control valve spacer, two gaskets, check balls and front servo assembly Note 21, oil pump Note 24, turbine shaft forward clutch housing, direct clutch assembly, sun gear shaft and front band Note 26.)

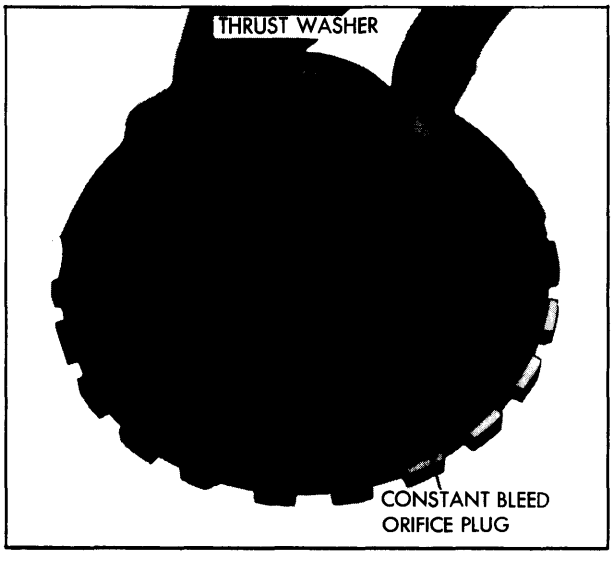


Fig. 7-41 Removing Center Support to Reaction Carrier Thrust Washer

1. Remove center support bolt from transmission case using 3/8 inch 12-point thin wall deep socket.

2. Remove intermediate clutch backing plate to case snap ring.

3. Remove intermediate clutch backing plate, and three composition and three steel clutch plates.

4. Using needle nose pliers, or screwdriver, remove center support to case snap ring.

5. Install Tool, J-21795, on end of main shaft so that tangs engage groove in shaft. Tighten screw on tool to secure tool on shaft and prevent movement of roller clutch during removal of gear unit assembly, Fig. 7-40.

6. Install proper diameter length of pipe over output shaft to be used as a handle and to prevent spline damage to case bushing when removing gear unit, center support, and reaction carrier.

(NOTE: Loosen transmission holding fixture pivot pin slightly, so that gear unit assembly does not bind when it is removed from case.)

7. With transmission case in a horizontal position, shift complete assembly toward front of case to facilitate removal of assembly from case. Remove complete gear unit assembly from case.

CAUTION: Be careful not to drop or bump assembly in transmission case during removal. This could result in damage to output shaft bushing in case as well as to assembly itself.

8. Remove output shaft to case thrust washer from output shaft or case.

9. Using Adapter. J-21364, in Rear Unit Holding Fixture, J-6116-01, place gear unit assembly in holding fixture with mainshaft pointing upward, Fig. 7-40 Remove Tool J-21795.

10. Remove rear unit selective washer from transmission case.

11. Remove the center support to case spacer (refer to Fig. 7-176.)

12. Remove rear band assembly. To facilitate removal, rotate band lugs away from pins and pull band assembly out of transmission case.

13. Remove center support assembly from reaction carrier by lifting straight upward.

14. Remove center support to reaction carrier thrust washer, Fig. 7-41.

(NOTE: Thrust washer may have stuck to back of center support. If so, remove from center support.)

15. Remove reaction carrier and roller clutch assembly from output carrier, Fig. 7-42, and remove roller clutch assembly from reaction carrier.

BACK TO INDEX

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TRANSMISSION DISASSEMBLY, CLEANING, INSPECTION AND ASSEMBLY OF INDIVIDUAL UNITS

Inspect each part thoroughly after the transmission and individual units have been disassembled and cleaned, to determine which parts should be replaced. It is very important to distinguish between parts that are simply "worn-in" and those parts worn to the extent that they affect operation of the unit. Only "worn-out", broken or damaged parts should be replaced.

29. Inspection of Torque Converter

1. Check converter for leaks as described in Note 13.
2. Check converter hub surfaces for signs of scoring or wear.

30. Inspection of Vacuum Modulator and Valve

1. Inspect vacuum modulator for any signs of bending or distortion.
2. Inspect O-ring seat for damage.
3. Inspect modulator valve for nicks or damage.
4. Check freeness of valve operation in case bore.
5. Check modulator for damaged bellows. Modulator plunger is under approximately 16 pounds pressure. If bellows is damaged, plunger will have very little pressure. Use procedure outlined in Diagnosis Part V.

31. Inspection of Extension Housing

1. Inspect bushing and rear seal for excessive wear or damage.
2. Inspect gasket mounting face for damage.

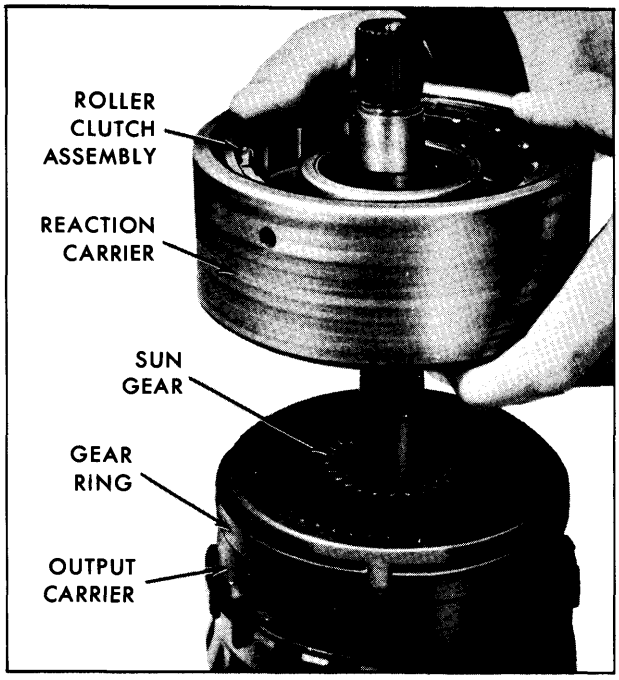


Fig. 7-42 Roller Clutch Assembly

3. Inspect housing for cracks or porosity.
4. Be sure rear seal drain back port is not blocked.

32. Inspection of Detent Lever, Manual Shaft, and Parking Linkage

1. Inspect parking actuator rod for cracks, or broken spring retainer lugs.
2. Inspect actuator spring for damage.
3. Inspect actuator for a free fit on actuator rod.
4. Inspect parking pawl for cracks or wear.
5. Inspect manual shaft and lip seal for damage.
6. Inspect inside detent lever for cracks or a loose pin.
7. Inspect parking pawl return spring for deformed coils or ends.
8. Inspect parking bracket for cracks or wear.
9. Inspect detent spring and roller assembly.

33. Inspection of Transmission Case

1. Inspect case assembly for cracks, porosity or interconnected passages, Fig. 7-8 and 7-9.
2. Check for good retention of band anchor pins.
3. Inspect all threaded holes for thread damage.
4. Inspect intermediate clutch driven plate lugs for damage or brinelling.
5. Inspect snap ring grooves for damage.
6. Inspect governor assembly bore for scratches or scoring.
7. Inspect modulator valve bore for scoring or damage.
8. Inspect cup plug inside case for good staking and sealing, Fig. 7-9.

CAUTION: If the case assembly requires replacement, make sure the center support to-case spacer is removed from the old case and reinstalled in the new case.

(NOTE: If the case assembly requires replacement, remove the nameplate from the old case and reinstall it onto the new case, using the truss head nameplate attaching screw that is serviced with the case.)

34. Governor Assembly (Fig. 7-43)

All components of the governor assembly, with the exception of the driven gear, are a select fit and each assembly is calibrated. The governor, including the driven gear, is serviced as a complete assembly. However, the driven gear can also be serviced separately.

It is necessary to disassemble the governor assembly in order to replace the driven gear. Disassembly may also be necessary due to foreign material causing improper operation. In such cases, proceed as follows:

BACK TO INDEX

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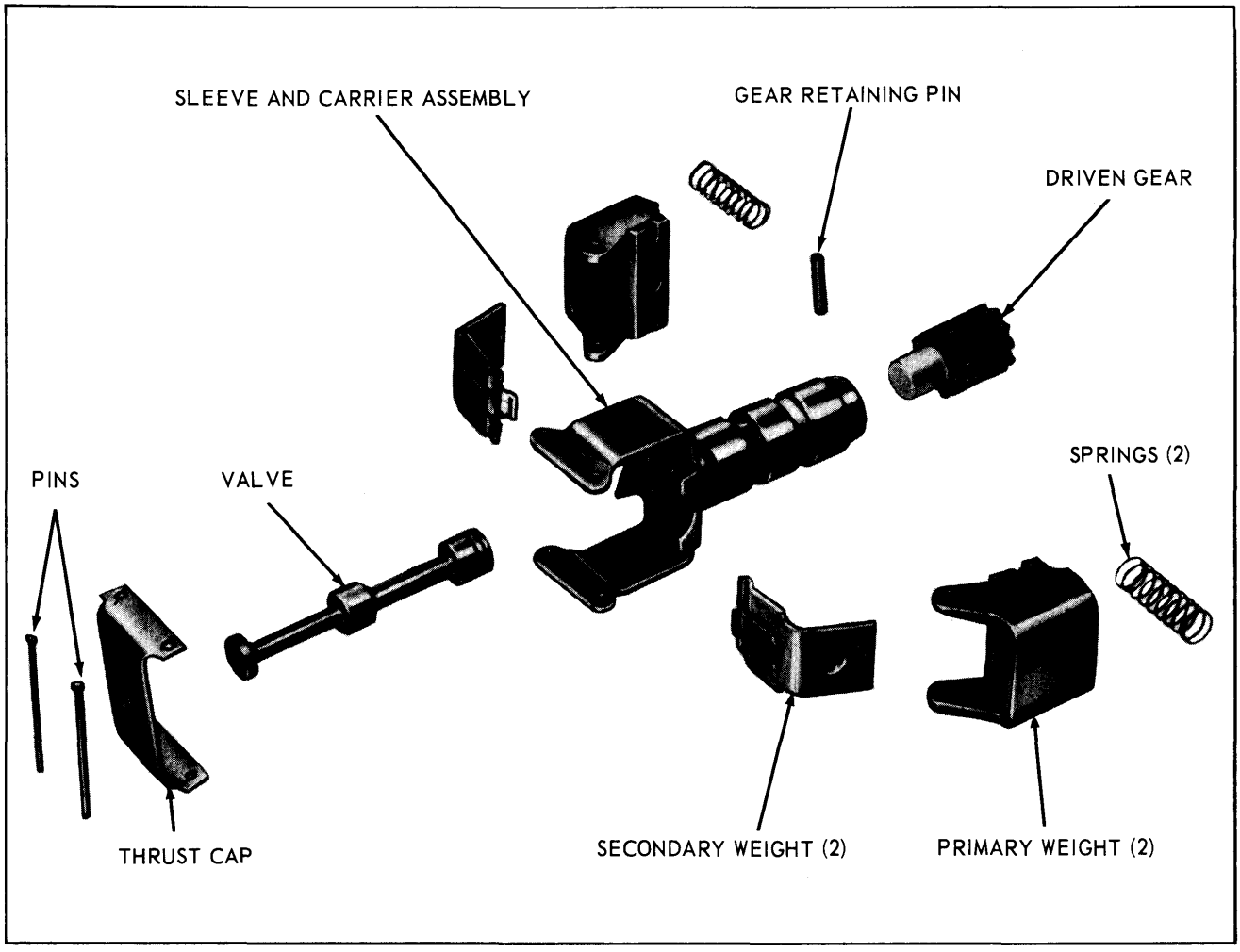


Fig. 7-43 Governor Assembly—Disassembled View

a. Disassembly

1. Cut off one end of each governor weight pin and remove pins, governor thrust cap, governor weights, and springs. Governor weights are interchangeable from side to side and need not be identified.
2. Remove governor valve from governor sleeve. Be careful not to damage valve.
3. Perform the following inspections and replace governor driven gear if necessary.

b. Inspection

1. Wash all parts in cleaning solvent, air dry and blow out all passages.
2. Inspect governor sleeve for nicks, burrs, scoring and galling.
3. Check governor sleeve for free operation in bore of transmission case.
4. Inspect governor valve for nicks, burrs, scoring or galling.
5. Check governor valve for free operation in bore of governor sleeve.
6. Inspect governor driven gear for nicks, burrs, or damage.
7. Check governor driven gear for looseness on governor sleeve.
8. Inspect governor springs for distortion or damage.
9. Check governor weights for free operation in their retainers.
10. Check valve opening at entry (.020" minimum) with a feeler gage, holding governor as shown with governor weights extended completely outward, Fig. 7-44.
11. Check valve opening at exhaust (.020" minimum) with a feeler gage, holding governor as shown with governor weights completely inward, Fig. 7-45.

c. Governor Driven Gear Replacement

To facilitate governor repair in the field, a governor driven gear and replacement pins are available for service use. The service package contains a nylon driven gear, two governor weight retaining pins and one governor gear retainer split pin. Replacement of gear must be performed with care in the following manner:

1. Drive out governor gear retaining split pin using small punch, Fig. 7-46.
2. Support governor on 3/16 inch plates installed in

BACK TO INDEX

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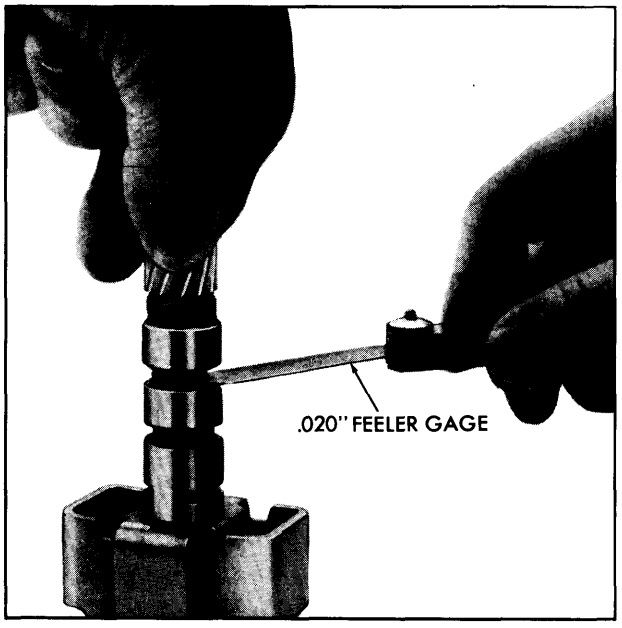


Fig. 7-44 Checking Valve Opening—Weights Extended

exhaust slots of governor sleeve, place in arbor press and, with a long punch, press gear out of sleeve.

3. Carefully clean governor sleeve of chips that remain from original gear installation.

4. Support governor on 3/16 inch plates installed in exhaust slots of sleeve, position new gear in sleeve and, with a suitable socket, press gear into sleeve until nearly seated. Carefully remove any chips that may have shaved off gear hub and press gear in until it bottoms on shoulder.

5. A new pin hole must be drilled through sleeve and gear. Locate hole position 90° from existing hole, center punch, and then while supporting governor in press, drill new hole through sleeve and gear using a 1/8 inch drill.

6. Install split retainer pin.

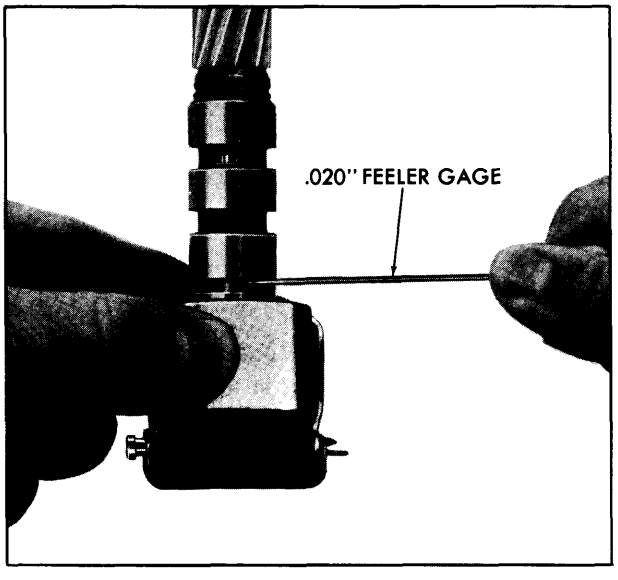


Fig. 7-45 Checking Valve Opening—Weights Inward

7. Wash governor assembly thoroughly to remove any chips that may have collected.

d. Assembly

1. Install governor valve in bore of governor sleeve.

2. Install governor weights and springs, and thrust cap on governor sleeve.

3. Align pin holes in thrust cap, governor weight assemblies, and governor sleeve, and install new pins. Crimp both ends of pins to prevent them from falling out.

4. Check governor weight assemblies for free operation on pins and valve for freeness in sleeve bore.

35. Speedometer Driven Gear Assembly and Transmission Speed Sensor

a. Disassembly

1. Remove speedometer driven gear from sleeve or sensor.

2. Remove O-ring from speedometer driven gear sleeve or sensor.

3. Remove C-wire ring retaining sleeve to gear lip seal.

4. Remove lip seal.

b. Inspection

1. Inspect gear for damaged teeth or shaft.

2. Inspect sleeve or sensor for scores, damaged threads or cracks.

3. Inspect seals for cuts or damage.

4. Inspect sensor for corrosion on wire terminal.

c. Assembly

1. Install sleeve to gear lip seal.

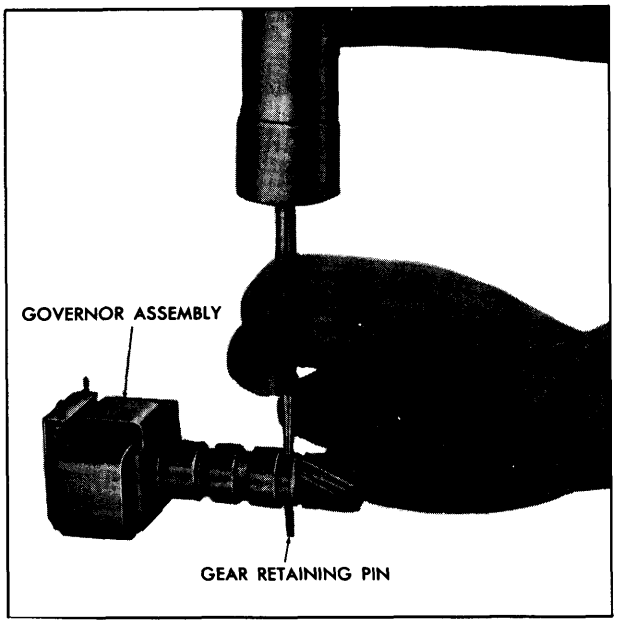
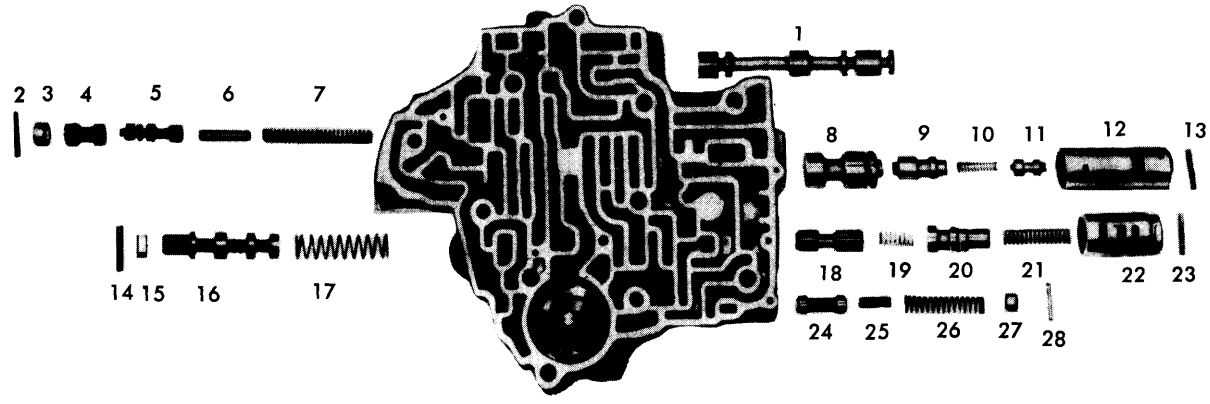


Fig. 7-46 Removing Governor Driven Gear Retaining Pin

BACK TO INDEX

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1. MANUAL VALVE
2. RETAINING PIN
3. BORE PLUG
4. DETENT VALVE
5. DETENT REGULATOR
6. SPACER
7. DETENT SPRING
8. 1-2 VALVE
9. 1-2 DETENT VALVE
10. 1-2 REGULATOR SPRING
11. 1-2 REGULATOR VALVE
12. 1-2 BUSHING
13. RETAINING PIN
14. RETAINING PIN
15. BORE PLUG
16. 1-2 ACCUMULATOR VALVE
17. 1-2 ACCUMULATOR PRIMARY SPRING
18. 2-3 VALVE
19. 3-2 INTERMEDIATE SPRING
20. 2-3 MODULATOR VALVE
21. 2-3 VALVE SPRING
22. 2-3 BUSHING
23. RETAINING PIN
24. 3-2 VALVE
25. SPACER
26. 3-2 SPRING
27. BORE PLUG
28. RETAINING PIN

Fig. 7-47 Control Valve Assembly—Disassembled View

2. Install C-wire retaining ring.
3. Install O-ring on speedometer driven gear sleeve.
4. Install gear in sleeve.

36. Control Valve Assembly (Fig. 7-47)

a. Diassembly

When diassembling control valve assembly make certain that springs are accurately identified so that they can be properly reassembled.

1. Position control valve assembly with gasket surface up and accumulator pocket on bottom.
2. Remove manual valve from upper bore.
3. Install Control Valve Accumulator Piston Installer, J-21885 or J-22269-01, on accumulator piston, compress piston and remove E-ring retainer, Fig. 7-48.
4. Remove Installer, J-21885 or J-22269-01, and remove accumulator piston and spring.
5. Using pin punch, remove retaining pin from upper right bore, pressing on pin from outer side of valve body. Remove 1-2 modulator bushing, 1-2 regulator valve and spring, 1-2 detent valve and 1-2 shift valve from upper right bore.

(NOTE: 1-2 regulator valve and spring may be inside of 1-2 modulator bushing.)

6. Using punch, remove retaining pin from center right bore, pressing on pin from outer side of valve body. Remove 2-3 modulator bushing, 2-3 shift valve spring,

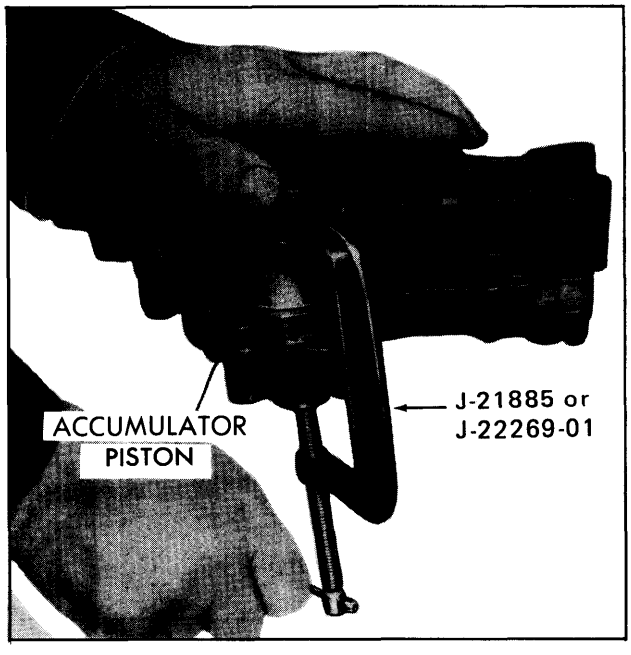


Fig. 7-48 Removing Front Accumulator Piston

BACK TO INDEX

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2-3 modulator valve, 3-2 intermediate spring and 2-3 shift valve from center right bore.

(NOTE: 2-3 modulator valve will be inside of 2-3 modulator bushing.)

7. Using pin punch, remove retaining pin from lower right bore, pressing on pin from outer side of valve body.

CAUTION: Hold hand over bore when removing retainer pin as 3-2 valve spring may force bore plug out.

8. Remove bore plug, 3-2 valve spring, spacer and 3-2 valve from lower right bore.

9. Using pin punch, remove retainer pin from upper left bore by pressing on outer side of valve body.

WARNING: HOLD HAND OVER BORE WHEN REMOVING RETAINER PIN AS DETENT REGULATOR VALVE SPRING MAY FORCE OTHER COMPONENTS OUT OF BORE.

10. Remove bore plug, detent valve, detent regulator valve, spacer and detent regulator valve spring from upper left bore.

11. Remove grooved retaining pin from lower left bore by prying out with long nose pliers.

12. Remove bore plug, 1-2 accumulator valve and primary spring from lower left bore.

b. Inspection

(NOTE: Do not remove the teflon oil seal ring from the front accumulator piston unless the oil seal ring requires replacement. The service oil seal ring is cast iron, Fig. 7-50.)



Fig. 7-49 Disassembling Rear Servo and Accumulator Piston

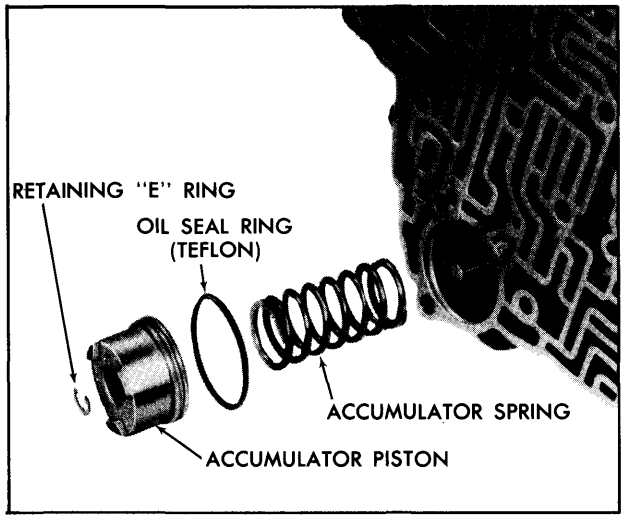


Fig. 7-50 Front Accumulator Disassembled View

CAUTION: The type of front accumulator piston used in 1971 thru 1976 is not interchangeable with pre-1971 piston.

1. Wash control valve body, valves, and other parts in clean solvent.

CAUTION: Do not allow valves to bump together, as this might cause nicks and burrs.

2. Inspect all valves and bushings carefully to make sure that they are free from dirt and are not damaged in any respect. If burrs are present, they should be removed with a fine stone or fine grade of crocus cloth and light oil. Be careful not to round off shoulders of valves.

3. All valves and bushings should be tested in their individual bores to make certain that free movement can be obtained. All valves should fall freely of their own weight with a slight tapping action on the body. In checking, be careful to prevent valve damage in any way.

4. The manual valve is the only valve that can be serviced separately. If other valves are malfunctioning or damaged beyond repair, a new control valve assembly should be installed.

5. Inspect body for cracks or scored bores.

6. Check all springs for distortion or collapsed coils.

7. Inspect front accumulator piston and oil ring for damage.

(NOTE: Refer to Fig. 7-7 for identification of control valve passages.)

c. Assembly

1. Position front accumulator spring and piston into valve body.

2. Install Control Valve Accumulator Piston Installer, J-21885 or J-22269-01, on piston. Compress spring and piston, aligning spring and piston with bore, Fig. 7-48.

BACK TO INDEX

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CAUTION: Make certain that piston pin is correctly aligned with hole in piston and that oil seal ring does not catch on lip of bore when installing piston.

3. Secure piston and spring with E-ring retainer and remove Installer, J-21885 or J-22269-01.
4. Install 1-2 accumulator primary spring into lower left bore Fig. 7-47.
5. Install 1-2 accumulator secondary valve, stem end out.
6. Install 1-2 accumulator bore plug into the 1-2 accumulator bore.
7. Place control valve body on gasket surface, compress plug and install grooved retaining pin from cast surface side of valve body, with grooved end of pin entering hole last.
8. Tap retaining pin with hammer until pin is flush with cast surface. Return control valve assembly to its original position.
9. Insert spacer inside of detent regulator valve spring and install spring and spacer into upper left bore, making certain spring seats in bottom of bore.
10. Compress detent regulator valve spring and hold with a small screwdriver placed between end of spring and wall on cored side of valve body.
11. Install detent regulator valve, stem end out, and detent valve, small land first, into upper left bore.
12. Insert bore plug, hole out, into upper left bore and, pressing inward on bore plug, remove screwdriver and install retaining pin from cored side of valve body.
13. Install 3-2 valve in bottom right bore.
14. Insert spacer inside of 3-2 valve spring and install spring and spacer in bottom right bore.
15. Compressing 3-2 valve spring, install bore plug, hole end out, and secure with retaining pin from cored side of valve body.
16. Install 3-2 intermediate spring in open end of 2-3 shift valve, and install valve and spring, valve first, into center right bore. Make certain valve seats in bottom of bore.
17. Install 2-3 modulator valve, hole end first, into 2-3 modulator bushing and install both parts in center right bore.
18. Install 2-3 shift valve spring into hole in 2-3 modulator valve, and compressing spring, secure with retaining pin from cored side of control valve.
19. Install 1-2 shift valve, stem end out, in upper right bore, making certain valve seats in bottom of bore.
20. Install 1-2 regulator valve, larger stem first, spring and 1-2 detent valve, hole end first, into 1-2 bushing, and install in upper right bore of control valve body.
21. Compress bushing against spring and secure with retaining pin from cored side of control valve body.
22. Install manual valve with detent pin groove to the right.

37. Rear Servo Assembly (Fig. 7-51)

a. Disassembly

1. Remove rear accumulator piston from rear servo piston. See Fig. 7-49.
2. Remove E-ring retaining rear servo piston to band apply pin.
3. Remove rear servo piston and seal from band apply pin.
4. Remove washer, spring and retainer.

b. Inspection

1. Check freeness of oil seal rings in piston grooves.

(NOTE: See Fig. 7-51. Do no remove the teflon oil seal rings from the rear accumulator piston, unless the oil seal rings requires replacement.

If the teflon inner oil seal ring, (small diameter) requires replacement, for service, use the aluminum oil seal ring.

The rear accumulator piston, large diameter ring groove depth, is machined shallower to take the large teflon oil seal ring, if this requires replacement, use only the teflon oil seal ring.)

2. Inspect fit of band apply pin in servo piston.
3. Inspect band apply pin for scores or cracks.
4. Inspect band apply pin for proper size as determined by pin selection check (note 20.)

c. Assembly

1. Install spring retainer with cup side toward band apply servo pin, spring and washer on servo pin.
2. Install servo piston on pin and secure with E-ring retainer.
3. If removed, install oil seal ring on servo piston.
4. If removed, install outer and inner oil rings on accumulator piston.
5. Install accumulator piston into bore of servo piston.

38. Front Servo Assembly (Fig. 7-52)

(NOTE: See Figure 7-52. Do not remove the teflon oil seal ring from the front servo piston unless the oil seal ring requires replacement. The service oil seal ring is aluminum.)

CAUTION: The spring retainer, servo pin, retainer ring and servo piston are identical for 1971 thru 1976 transmissions. These individual parts are not interchangeable with the pre-1971 parts.

a. Inspection

1. Inspect servo pin for damage.
2. Inspect piston and oil seal ring for damaged oil ring groove, check freedom of ring in groove.
3. Inspect piston for cracks or porosity.
4. Check fit of servo pin in piston.

b. Assembly

1. Reassemble parts of front servo, making sure tapered end of servo pin is pointing through the spring and spring retainer. Make sure the retainer ring is in the servo pin groove.

BACK TO INDEX

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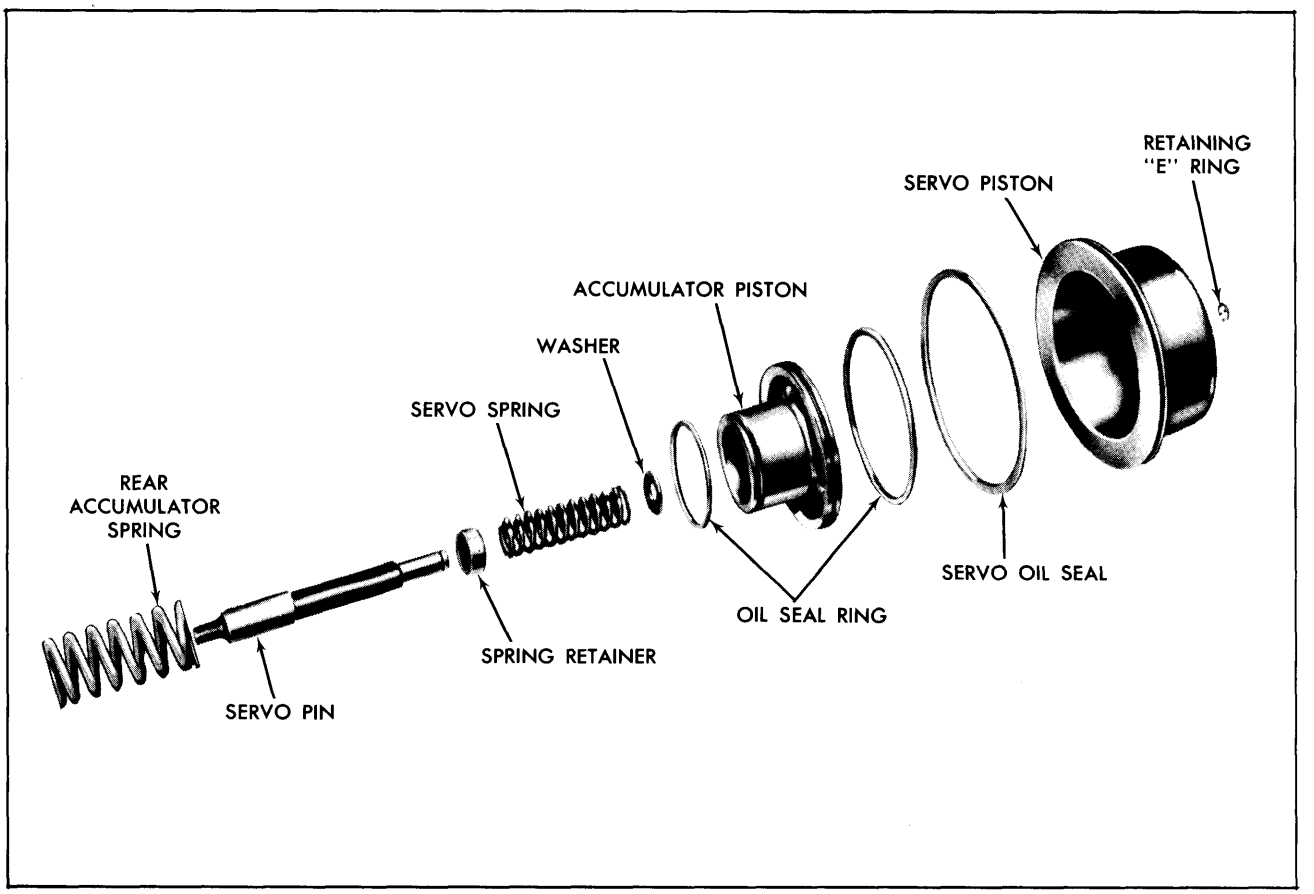


Fig. 7-51 Rear Servo and Accumulator

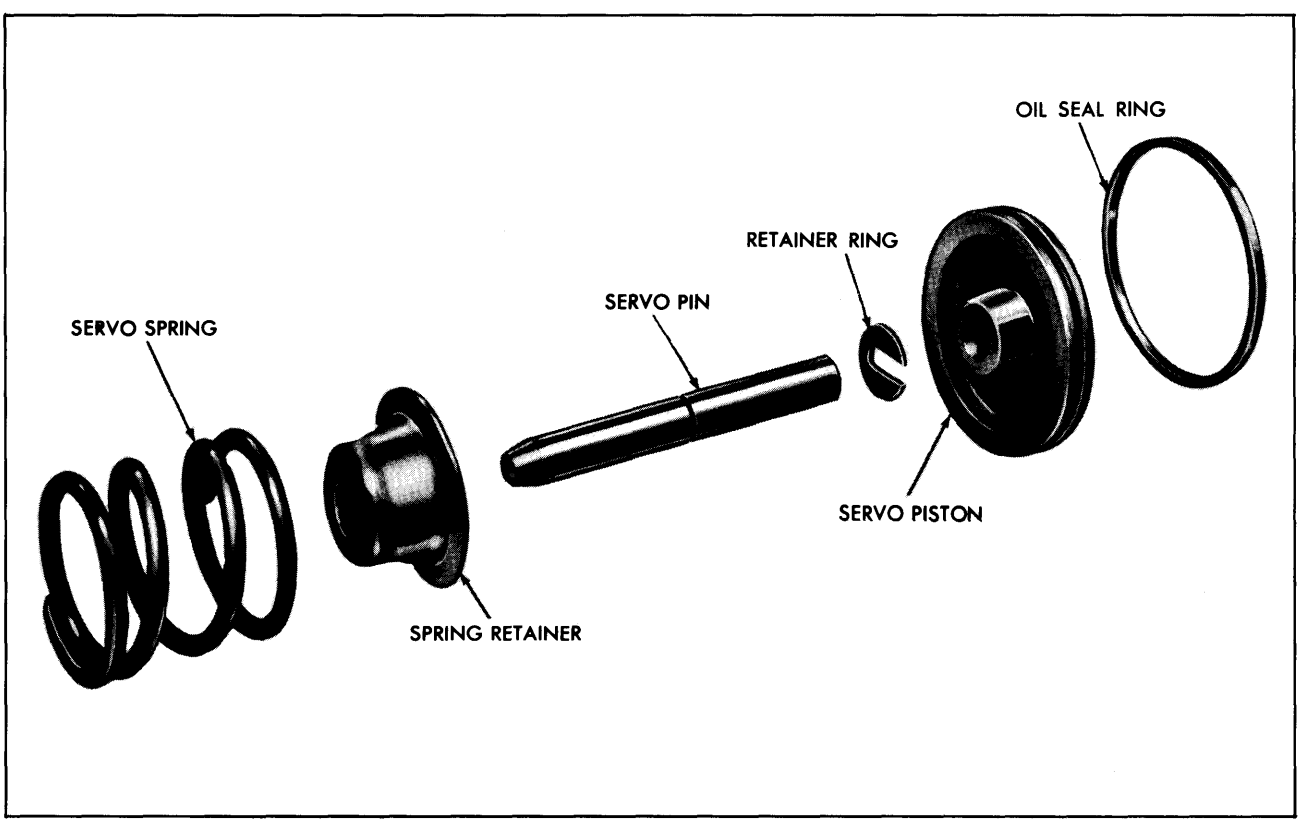


Fig. 7-52 Front Servo

BACK TO INDEX

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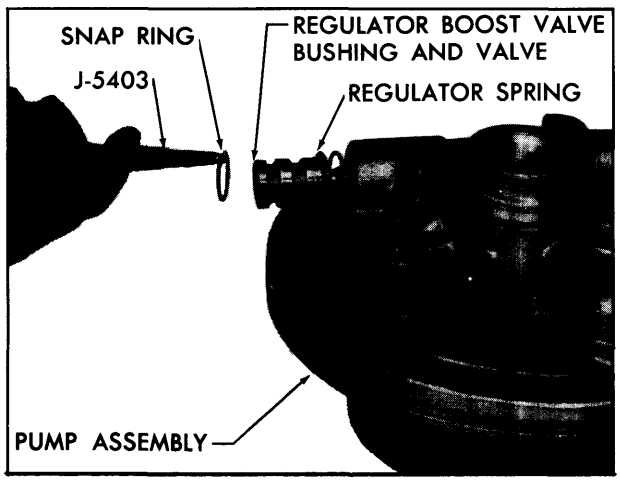


Fig. 7-53 Removing Pressure Regulator Valve Snap Ring

39. Oil Pump Assembly

a. Disassembly

1. Using Adapter, J-21364, in Rear Unit Holding Fixture, J-6116, place pump assembly in Holding Fixture with stator shaft pointing downward. Be careful not to damage shaft.

2. Compress regulator boost valve bushing against pressure regulator spring and remove snap ring using Snap Ring Pliers J-5403 (#21), Fig.7-53.

WARNING: PRESSURE REGULATOR SPRING IS TIGHTLY COMPRESSED.

3. Remove regulator boost valve bushing and valve.
4. Remove pressure regulator spring.
5. Remove regulator valve, spring retainer, and spacer or spacers if present.

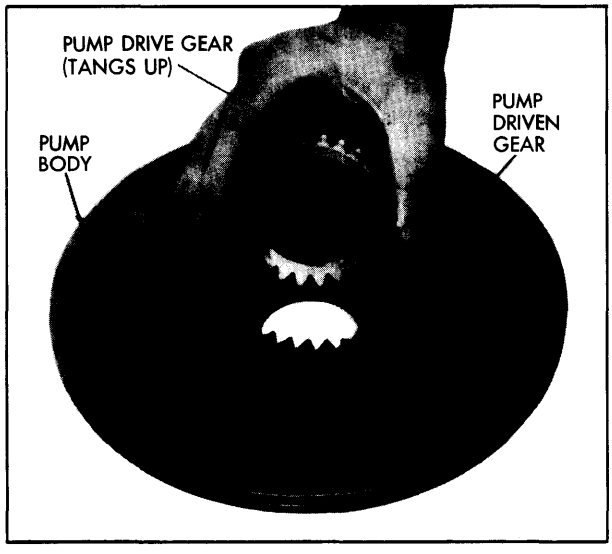


Fig. 7-54 Removing Pump Gears

6. Remove five pump cover attaching screws and remove pump cover from body.
7. Mark drive and driven gears for reassembly in same position and remove from pump body, Fig. 7-54.

(NOTE: Installing the gears in the same position as removed, will assure the quietest operation, as the gear teeth will mesh in the established wear pattern.)

8. Remove retaining pin and bore plug from end of regulator bore.
9. Remove two oil rings from pump cover.
10. Remove pump to forward clutch housing selective washer.
11. If necessary to replace front oil seal, pry seal from pump body, Fig. 7-21.

b. Inspection of Pump Body

1. Inspect gear pockets and crescent for scoring, galling or other damage.
2. Place pump gears in pump body and check pump body face to gear face clearance. Clearance should be .0008 inch-.0035 inch, Fig. 7-55.
3. Check face of pump body for scores or nicks.
4. Check oil passages for proper opening and lack of porosity.
5. Check for damaged cover bolt attaching threads.
6. Check for overall flatness of pump body face.
7. Check bushing for scores or nicks.

c. Inspection of Pump Cover (Fig. 7-56)

1. Inspect pump cover face for overall flatness.
2. Check for scores or dirt in pressure regulator bore.
3. Make certain all passages are open and not interconnected through porosity.
4. Check for scoring or damage at pump gear face.
5. Inspect stator shaft for damaged splines, or scored bushings.
6. Inspect oil ring grooves for damage or wear.
7. Inspect selective thrust washer face for wear or damage.
8. Inspect oil seal ring on pump body and remove if necessary.

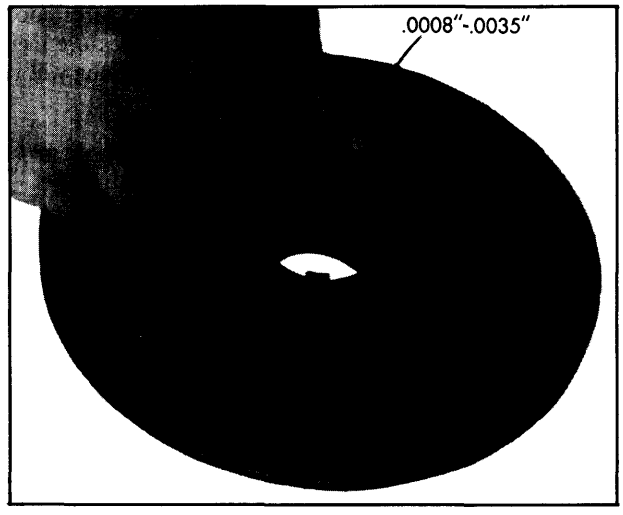


Fig. 7-55 Pump Body Face to Gear Face Clearance

BACK TO INDEX

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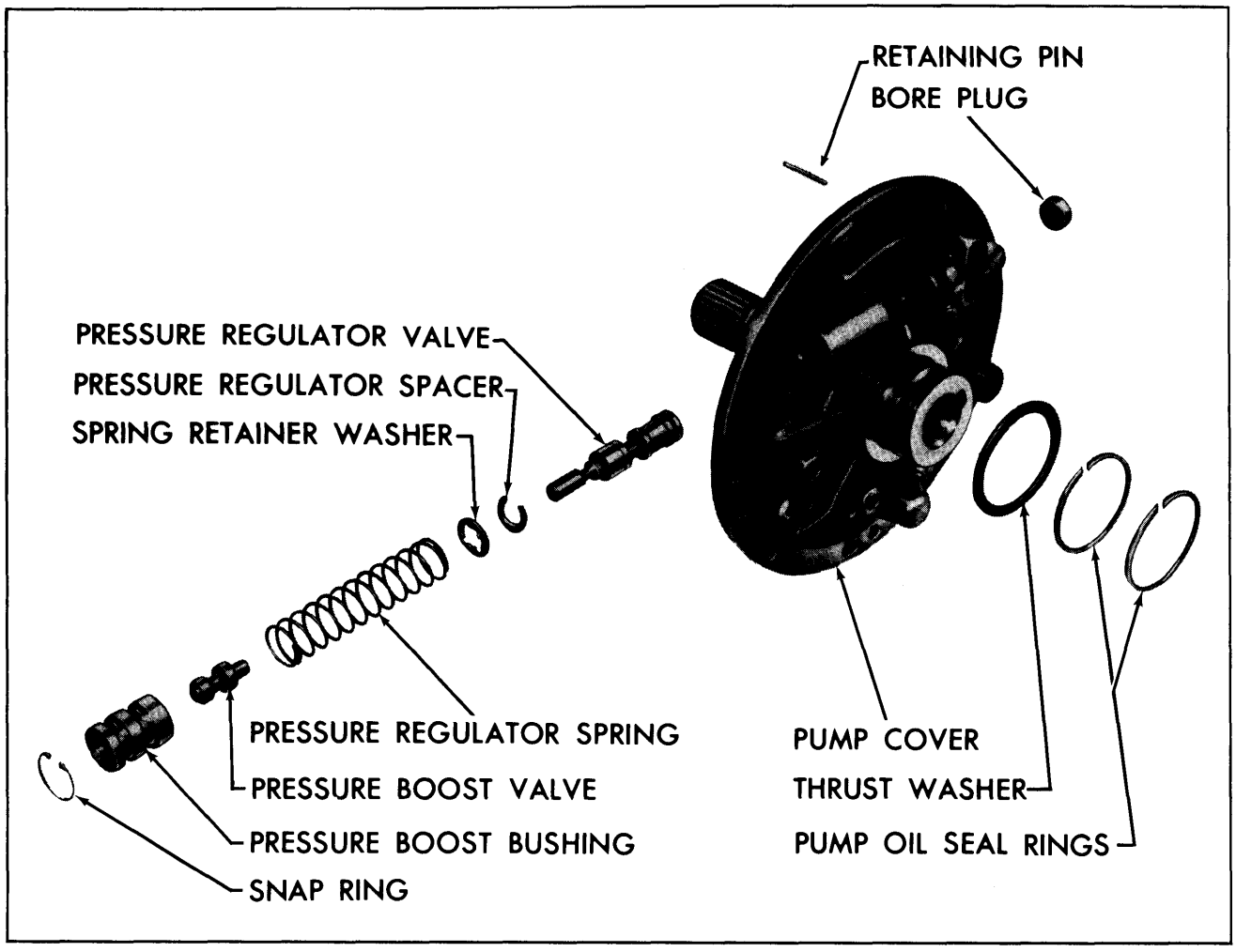


Fig. 7-56 Pump Cover Disassembled View

9. Inspect pressure regulator and boost valve for free operation.

(NOTE: The solid type pressure regulator valve does not contain oil holes and an orifice cup plug like the previous pressure regulator valve. The solid style valve must only be used in the pump cover with the squared off pressure regulator boss, (Pressure boost bushing end). See Fig. 7-19. The previous pressure regulator valve with the oil holes and orifice cup plug will be used to service either type pump cover.)

10. Inspect pump cover for open 1/8 inch diameter breather hole. See Fig. 7-12.

d. Assembly

1. Install drive and driven pump gears into pump body with alignment marks up and mated. In this position the pump gear drive tangs will also be up.
2. Install pressure regulator spacer or spacers, if required, spring retainer and spring into pressure regulator bore.
3. Install boost valve into bushing, stem end out, and install both parts into pump cover by compressing bushing against spring.
4. Install retaining snap ring.
5. Install pressure regulator valve from opposite end of bore, stem end first.
6. Install pressure regulator valve bore plug and retaining pin into end of bore.
7. Install previously selected front unit selective thrust washer over pump cover delivery sleeve.

(NOTE: Proper washer size was determined at time of front unit end play check (Note 24).

8. Install two oil seal rings, as shown in Fig. 7-57.
9. Place pump body in Rear Unit Holding Fixture, J-6116, with gasket surface facing up.
10. Lubricate pump gears with transmission fluid and install pump cover on pump body.
11. Install pump cover attaching screws following screw chart, Fig. 7-58. Leave screws one turn loose at this time.
12. Install pump Body and Cover Alignment Band, J-21368, around pump assembly. Tighten wing nut on alignment band to align pump cover with pump body, Fig. 7-59.
13. Tighten pump cover attaching screws to 18 foot-pounds and remove alignment band from pump.

BACK TO INDEX

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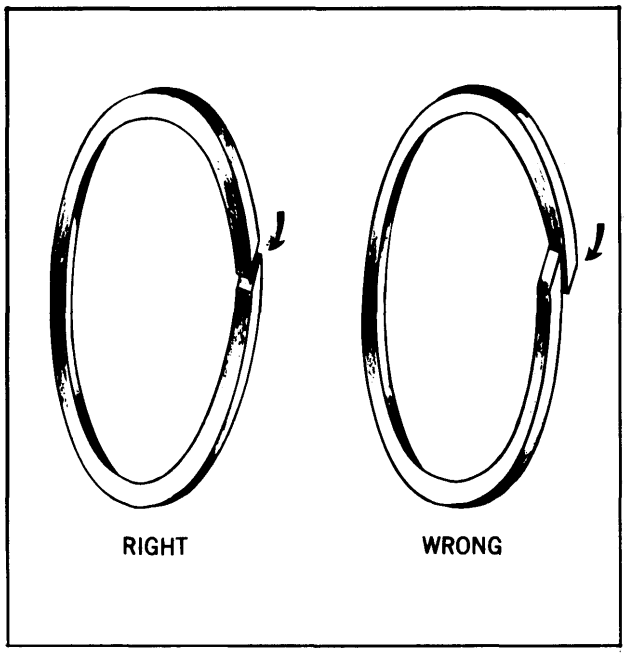


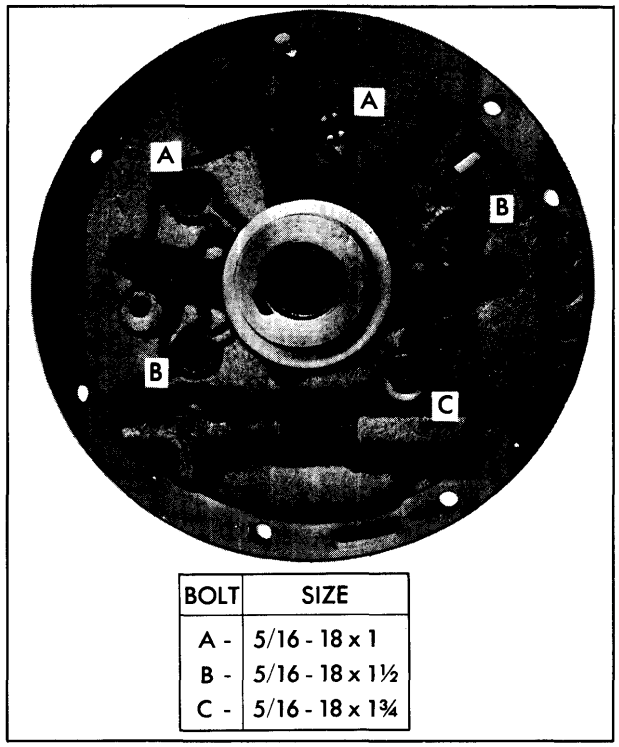
Fig. 7-57 Teflon Ring Lap Joint

14. Install new square cut O-ring on pump.
15. If necessary, install new pump oil seal using pump Oil Seal Installer, J-21359, Fig. 7-22.

40. Forward Clutch Assembly-Disassembly

a. Disassembly

1. Using Adapter, J-21364, in Rear Unit Holding Fixture, J-6116-01, place forward clutch assembly in Holding Fixture with turbine shaft pointing downward. Be careful not to damage shaft.
2. Remove forward clutch housing to direct clutch hub snap ring.
3. Remove direct clutch hub.
4. Remove forward clutch hub and one thrust washer from each side of hub, Fig. 7-60.
5. Remove five composition and five steel clutch plates.
6. Place forward clutch assembly in arbor press with turbine shaft pointing downward.
7. Using Clutch Spring Compressor, J-4670-01, and Adapter, J-21664, compress spring retainer with arbor press and remove snap ring using Snap Ring Pliers, J-8059 or J-5586, Fig. 7-61.
8. Remove tools, spring retainer and 16 clutch release springs. Keep springs separate from direct clutch springs.
9. Remove forward clutch piston from forward clutch housing.
10. Remove inner and outer seals from clutch piston.
11. Remove center piston seal from forward clutch housing.
12. It is not necessary to remove turbine shaft from forward clutch housing unless either shaft or housing is damaged and must be replaced. In such case proceed as follows:
    a. Place forward clutch housing in arbor press with turbine shaft pointing downward.
    b. Using 3/8 inch drive extension approximately 3 inches long, or similar tool as driver, press turbine shaft out of forward clutch housing.



BOLT	SIZE
A -	5/16 - 18 x 1
B -	5/16 - 18 x 1½
C -	5/16 - 18 x 1¾

Fig. 7-58 Pump Cover Attaching Screws

b. Inspection

1. Inspect composition faced and steel clutch plates for signs of burning, scoring or wear.
2. Inspect sixteen release springs for collapsed coils or signs of distortion.
3. Inspect clutch hubs for worn splines, proper lubrication holes, and thrust faces.

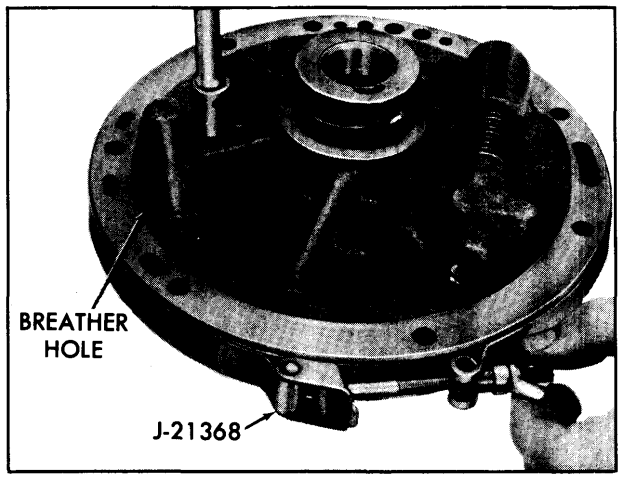


Fig. 7-59 Aligning Pump Cover and Body

BACK TO INDEX

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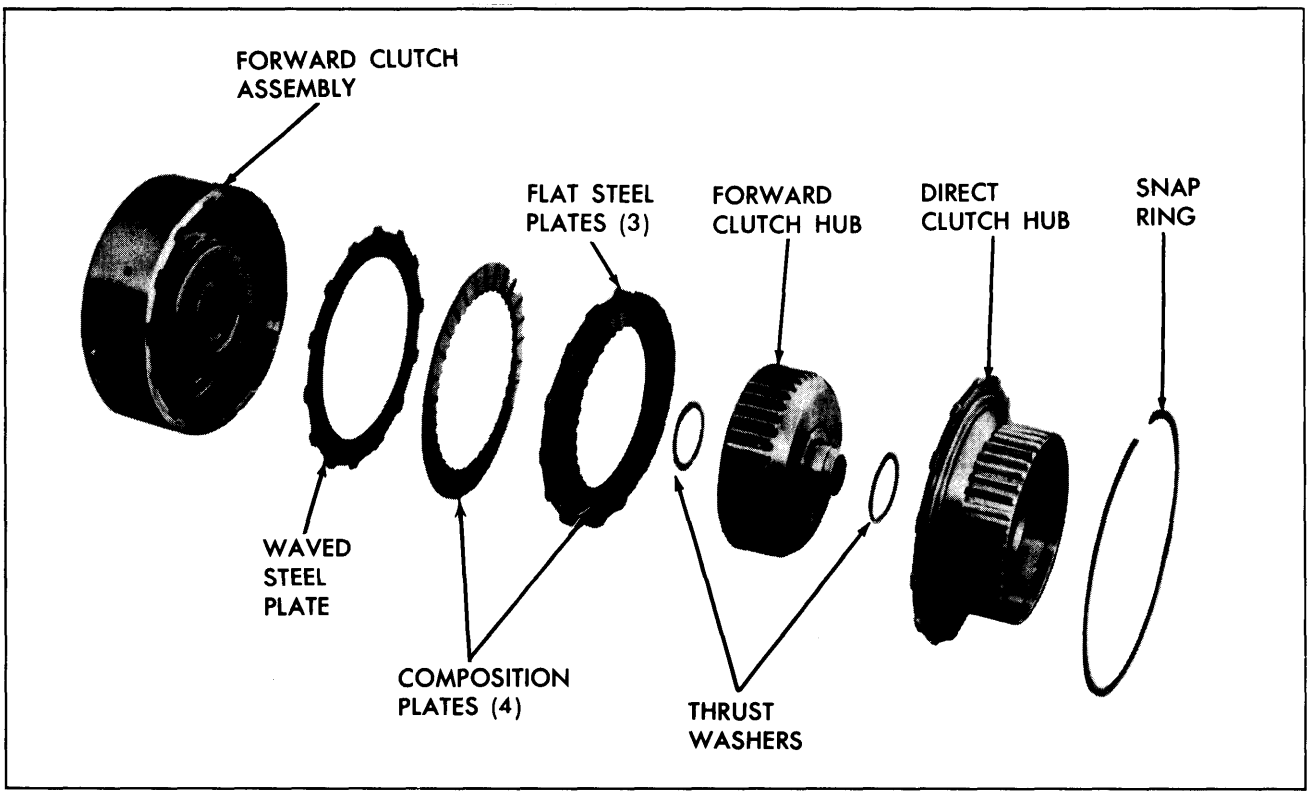


Fig. 7-60 Forward Clutch Assembly—Disassembled View

4. Inspect piston for cracks.
5. Inspect clutch housing for wear, scoring, cracks and open oil passages.
6. Inspect operation of ball check in forward clutch housing.
7. Inspect turbine shaft for open lubrication passages at each end.
8. Inspect turbine shaft splines for damage.
9. Inspect bushing journals for damage.
10. Inspect turbine shaft for cracks or distortion.

c. Assembly

1. If turbine shaft was previously removed from forward clutch housing proceed as follows:

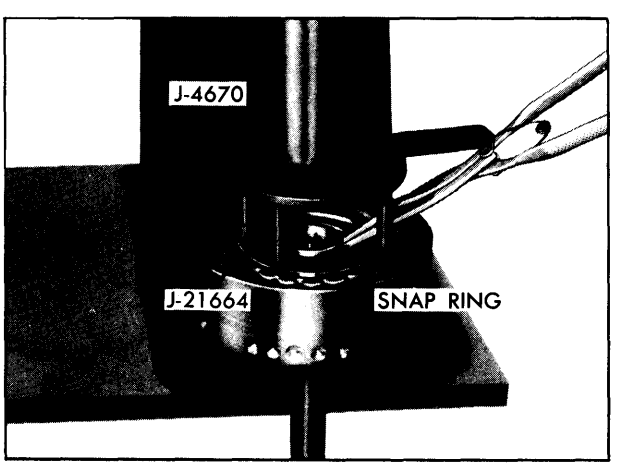


Fig. 7-61 Removing Forward Clutch Snap Ring

a. Place forward clutch housing on arbor press with flat side up.

b. Align shorter splined end of turbine shaft with splines in forward clutch housing, and using arbor press, carefully press shaft into housing until shaft bottoms on hub of housing.

CAUTION: Start shaft into housing and back off on arbor press to allow shaft to straighten itself. Repeat this step several times until you are certain shaft is going in straight, otherwise, shaft or housing splines may be damaged.

2. Invert forward clutch housing on arbor press with turbine shaft pointing downward.
3. Lubricate new inner and outer clutch piston seals with transmission fluid. Lubricate seal grooves in forward clutch piston with petrolatum and install seals with lips facing away from spring pockets.
4. Lubricate new center piston seal with transmission fluid. Lubricate seal groove in forward clutch housing with petrolatum and piston seal with transmission fluid. Lubricate seal groove in forward clutch housing with petrolatum and install seal into clutch housing with lip facing up.
5. Place Forward and Direct Clutch Inner Seal Protector, J-21362, over forward clutch hub. Install clutch piston inside Forward and Direct Clutch Piston Installer, J-21409, insert assembly in forward clutch housing, Fig. 7-62, and install clutch piston by rotating it slightly in a clockwise direction until seated.
6. Install sixteen clutch release springs into spring pockets in clutch piston.

BACK TO INDEX

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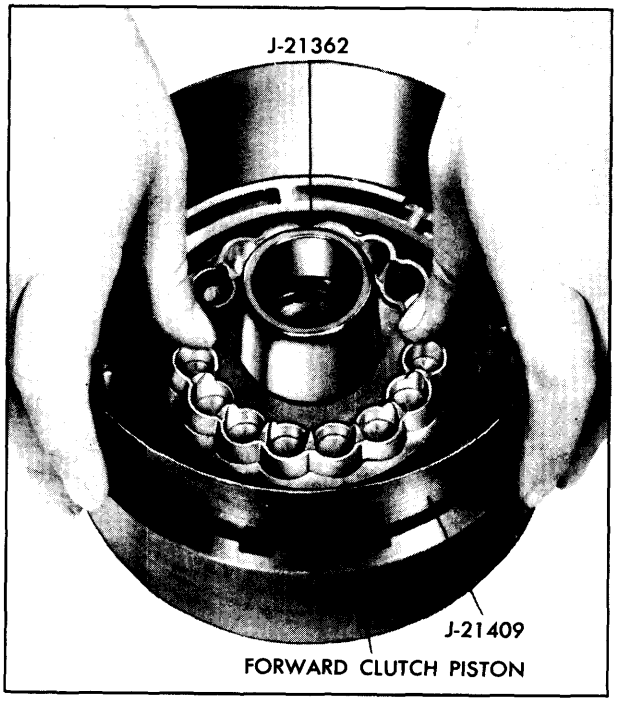


Fig. 7-62 Installing Forward Clutch Piston

7. Using Clutch Spring Compressor, J-4670-01, and Adapter, J-21664, compress spring retainer with arbor press, being careful that retainer does not catch in snap ring groove, and install snap ring using Snap Ring Pliers, J-8059 or J-5586, Fig. 7-61. Remove tools.

CAUTION: Make certain clutch release springs are not leaning. If necessary, straighten with a small screwdriver.

8. Remove forward clutch assembly from arbor press and place in Holding Fixture, J-6116-01, with turbine shaft pointing down. Be careful not to damage shaft.

9. Install thrust washer on the outside of forward clutch hub. The bronze washer is installed on side of hub facing forward clutch housing.

10. Install forward clutch hub in forward clutch housing.

11. Lubricate the four flat steel, five composition and one waved U-notched steel clutch plates with transmission fluid and install clutch plates in forward clutch housing, Fig. 7-60. Start with waved steel plate and alternate composition and steel plates.

12. Install direct clutch hub in forward clutch housing over clutch plates, and install snap ring.

13. Place forward clutch housing on pump delivery sleeve and air check clutch operation by applying air through forward clutch passage in pump, Fig. 7-63 to actuate piston and move forward clutch.

41. Direct Clutch and Intermediate Roller Assembly (Fig. 7-65)

a. Disassembly

1. Remove roller retainer snap ring, and remove clutch retainer.

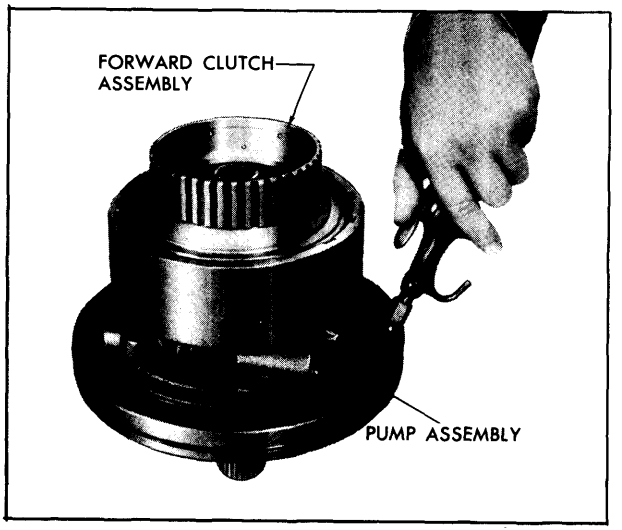


Fig. 7-63 Air Checking Forward Clutch

2. Remove roller outer race and remove roller assembly. See Fig. 7-64.

3. Turn unit over and remove direct clutch backing plate to clutch housing snap ring.

4. Remove direct clutch backing plate and six composition and six steel clutch plates, Fig. 7-66.

5. Using Clutch Spring Compressor, J-4670, Rear Clutch Spring Compressor, J-6129, or an arbor press, and Adapter J-21664. Fig. 7-67, compress spring retainer and remove snap ring with Snap Ring Pliers, J-8059 or J-5586.

6. Remove tools, spring retainer and 14 clutch release springs. Keep springs separate from forward clurch springs.

7. Remove direct clutch piston from direct clutch housing.

8. Remove inner and outer seals from clutch piston.

9. Remove center piston seal from direct clutch housing.

b. Inspection

1. Inspect roller clutch assembly for damaged rollers, cage or springs.

2. Inspect cam and outer race for scratches or wear.

3. Inspect clutch housing for cracks, wear, proper opening of oil passages and wear on clutch plate drive lugs.

4. Inspect composition-faced and steel clutch plates for signs of wear or burning.

5. Inspect backing plate for scratches or other damage.

6. Inspect piston for cracks.

7. Inspect springs for collapsed coils or signs of distortion.

8. Inspect housing for face operation of check ball.

(NOTE: The 14 direct clutch release springs are not serviced individually. If one or more of these springs require replacement, discard all of them and install the 16 service direct clutch release springs.)

BACK TO INDEX

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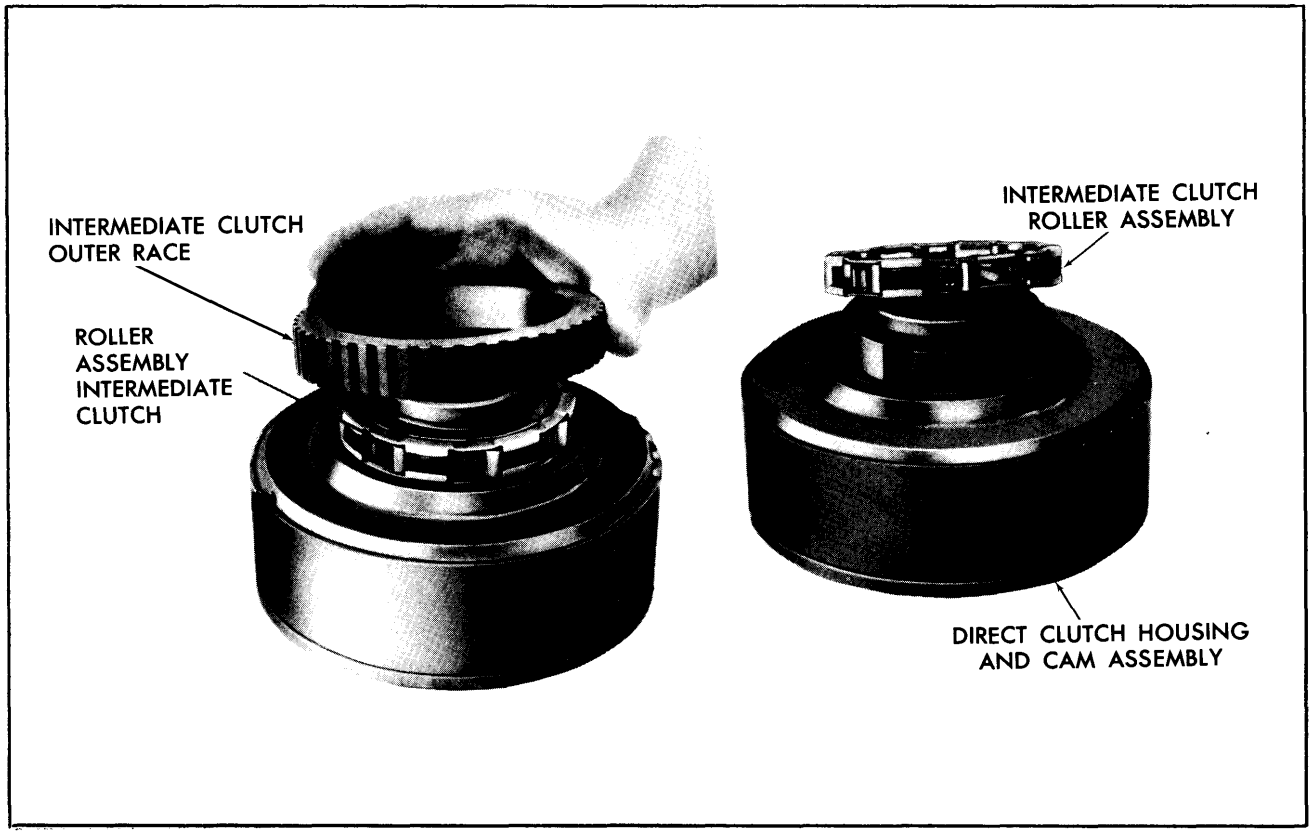


Fig. 7-64 Removing Roller Outer Race and Assembly

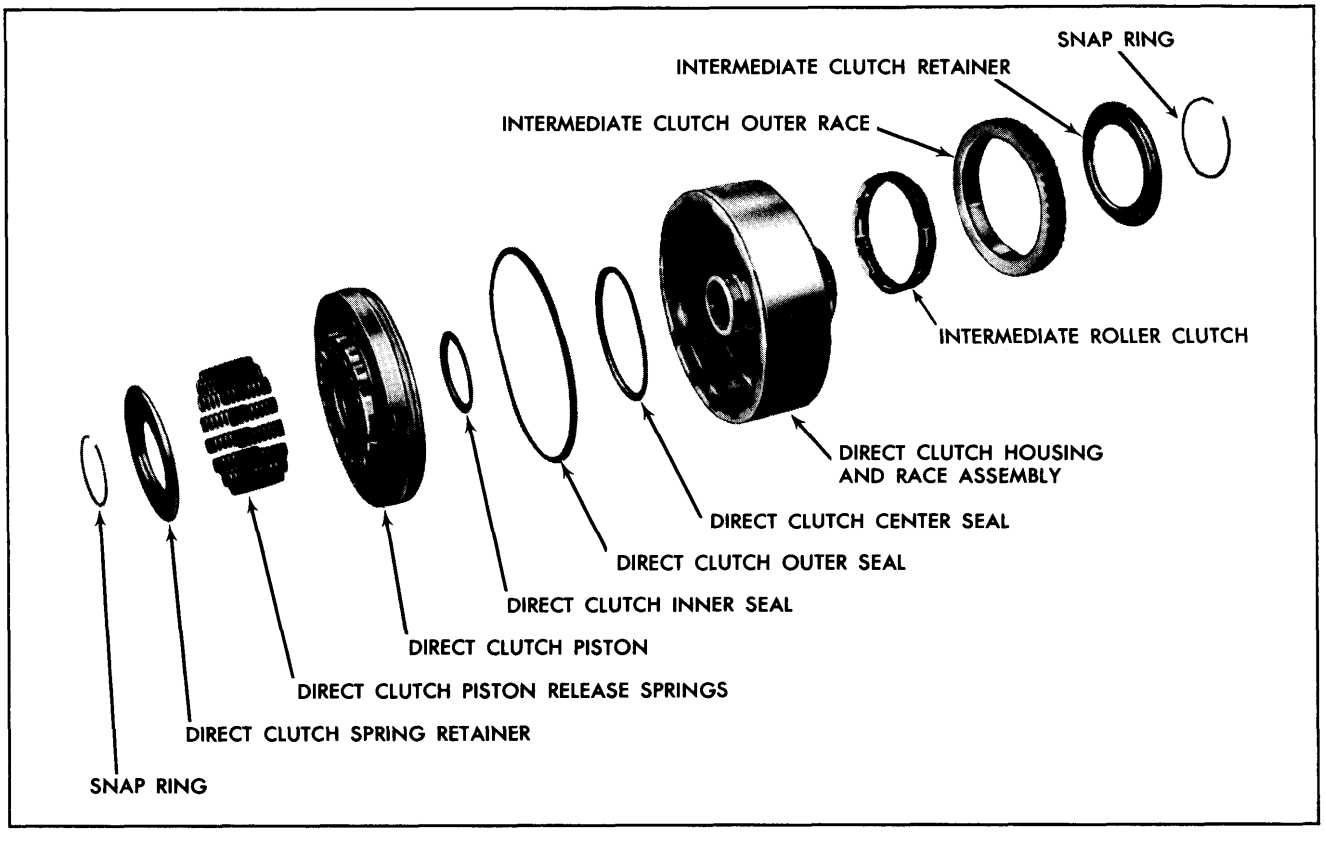


Fig. 7-65 Direct Clutch and Piston

BACK TO INDEX

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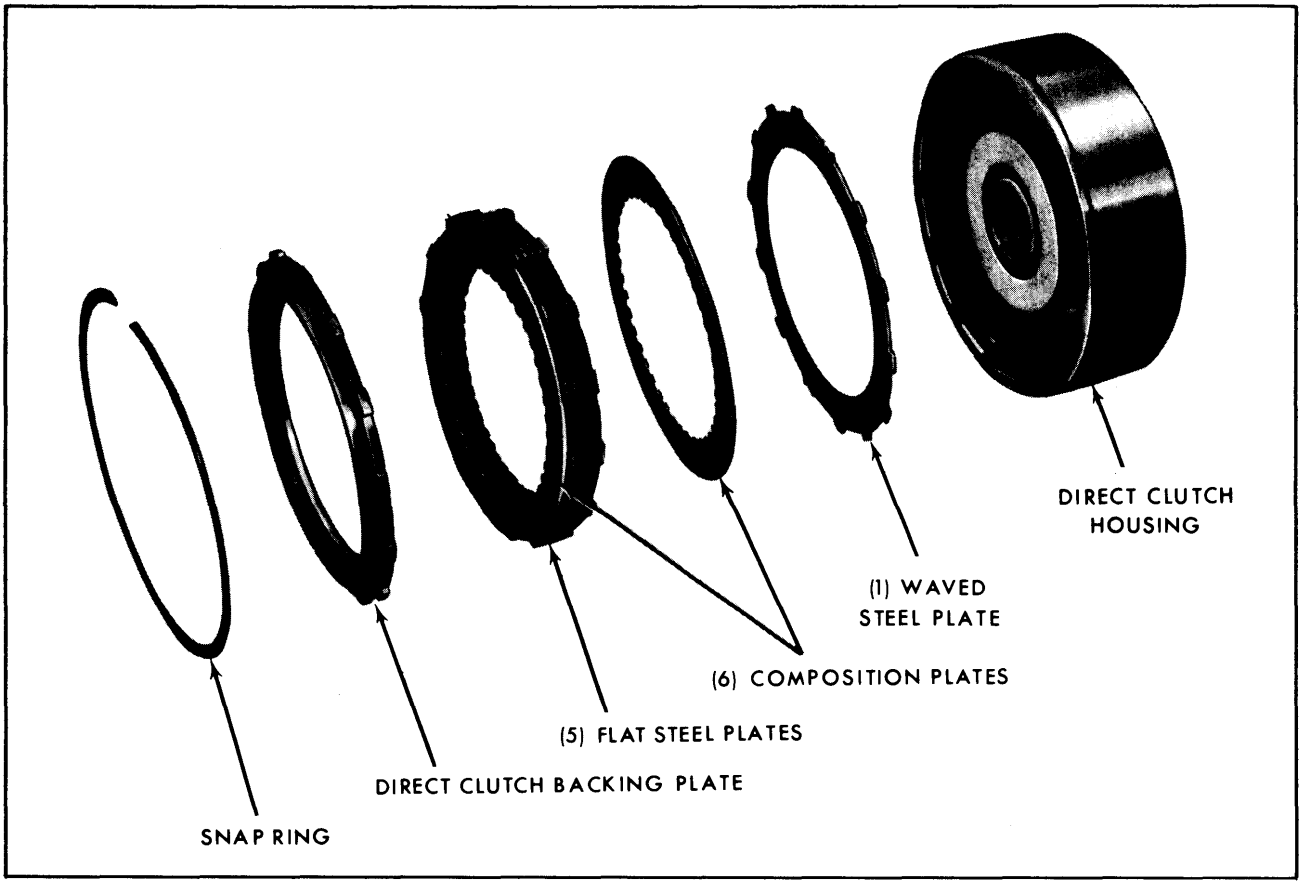


Fig. 7-66 Direct Clutch—Disassembled View

c. Assembly

1. Lubricate new inner and outer clutch piston seals with transmission fluid. Lubricate seal grooves in direct clutch piston and install seals with lips facing away from spring pockets.

2. Lubricate new center seal with transmission fluid. Lubricate seal groove in direct clutch housing and install seal in clutch housing with lip facing up.

3. Place Forward and Direct Clutch Inner Seal Protector, J-21362, over direct clutch hub. Install clutch piston inside Forward and Direct Clutch Piston Installer, J-21409, insert assembly in direct clutch housing, Fig. 7-68, and install clutch piston by rotating it slightly, in a clockwise direction.

4. Install 14 (16 if service) clutch release springs into spring pockets in clutch piston.

5. Place spring retainer and snap ring over springs.

6. Using Clutch Spring Compressor, J-4670-01, Rear Clutch Spring Compressor, J-6129, or an arbor press, and Adapter, J-21664, Fig. 7-67, compress spring retainer, being careful that retainer does not get caught in snap ring groove, and install snap ring with Snap Ring Pliers, J-8059 or J-5586. Remove tools.

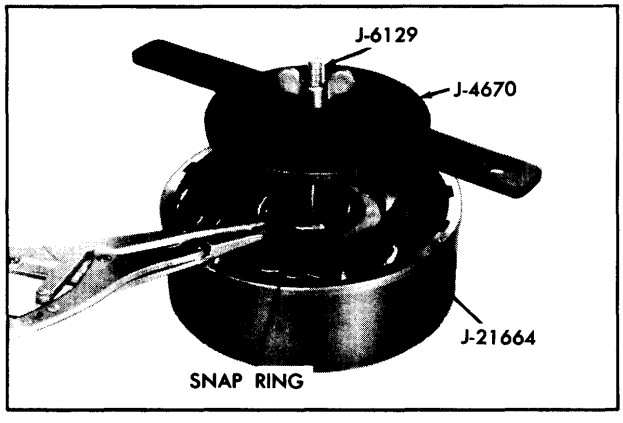


Fig. 7-67 Removing Direct Clutch Snap Ring

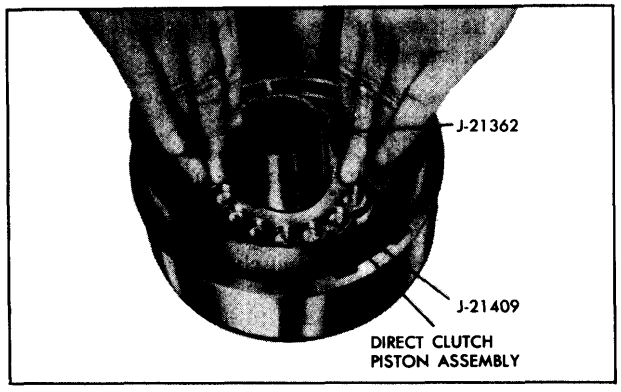


Fig. 7-68 Installing Direct Clutch Piston

BACK TO INDEX

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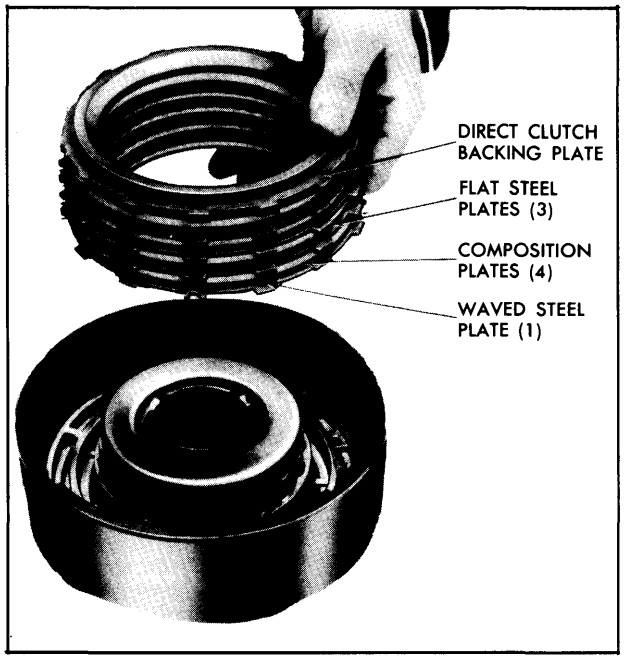


Fig. 7-69 Installing Direct Clutch Plates

(NOTE: Make certain clutch release springs are not leaning. If necessary, straighten spring with a small screwdriver.)

7. Lubricate the five flat and one waved, U-notched steel and six composition clutch plates with transmission fluid and install clutch plates in direct clutch housing Fig. 7-69. Start with waved steel plate and alternate composition faced and flat steel plates.

(NOTE: Do not use radially grooved composition plates here.)

(NOTE: All direct clutch flat steel plates are .0915 in. thick.)

8. Install direct clutch backing plate over clutch plates and install backing plate snap ring.

(NOTE: Install rollers that may have come out of the roller cage by compressing the energizing spring with forefinger and inserting the roller from the outer side.

Turn unit over and install the roller clutch assembly onto the intermediate clutch inner cam.

Install the intermediate clutch outer race with a clockwise turning motion.)

(NOTE: When installed, outer race should not turn counterclockwise, Fig. 7-70.)

9. Install roller clutch assembly retainer and snap ring.

10. Place direct clutch assembly on center support and air check operation of direct clutch, Fig. 7-71.

(NOTE: If air is applied through reverse passage, (right oil feed hole) it will escape from direct clutch passage (left oil feed hole). This is considered normal. Apply air through left oil feed hole to actuate piston and move direct clutch plates.)

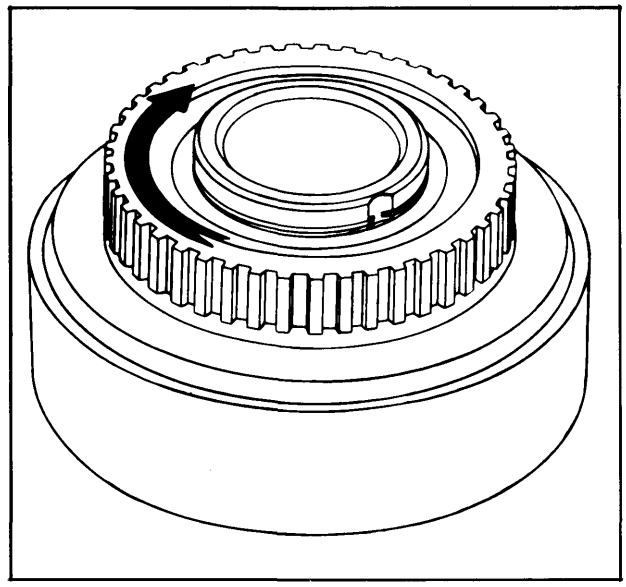


Fig. 7-70 Roll Clutch Rotation

42. Center Support and Intermediate Clutch Piston

a. Disassembly (Fig. 7-72)

1. Remove four oil rings from the center support, Fig. 7-73.

2. Compress spring retainer and remove snap ring with Snap Ring Pliers, J-8059 or J-5586, Fig. 7-74.

3. Remove spring retainer and 3 intermediate clutch release springs.

4. Remove spring guide.

5. Remove intermediate clutch piston from center support.

6. Remove inner and outer seals from clutch piston.

(NOTE: Do not remove the three screws retaining roller clutch inner race to center support.)

b. Inspection

1. Inspect roller clutch inner race for scratches or indentations. Be sure lubrication hole is open.

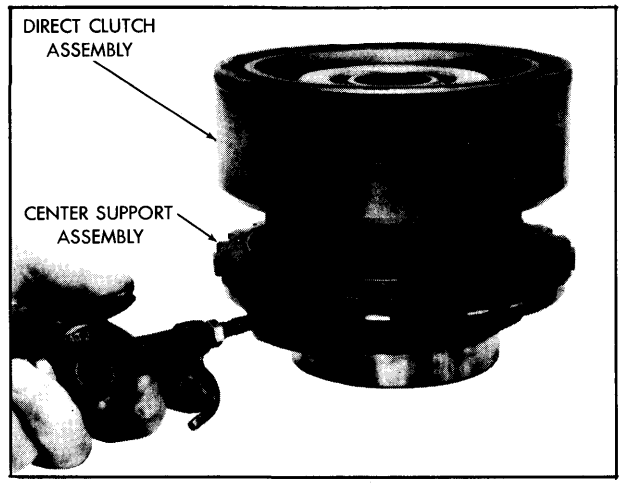


Fig. 7-71 Air Checking Direct Clutch

BACK TO INDEX

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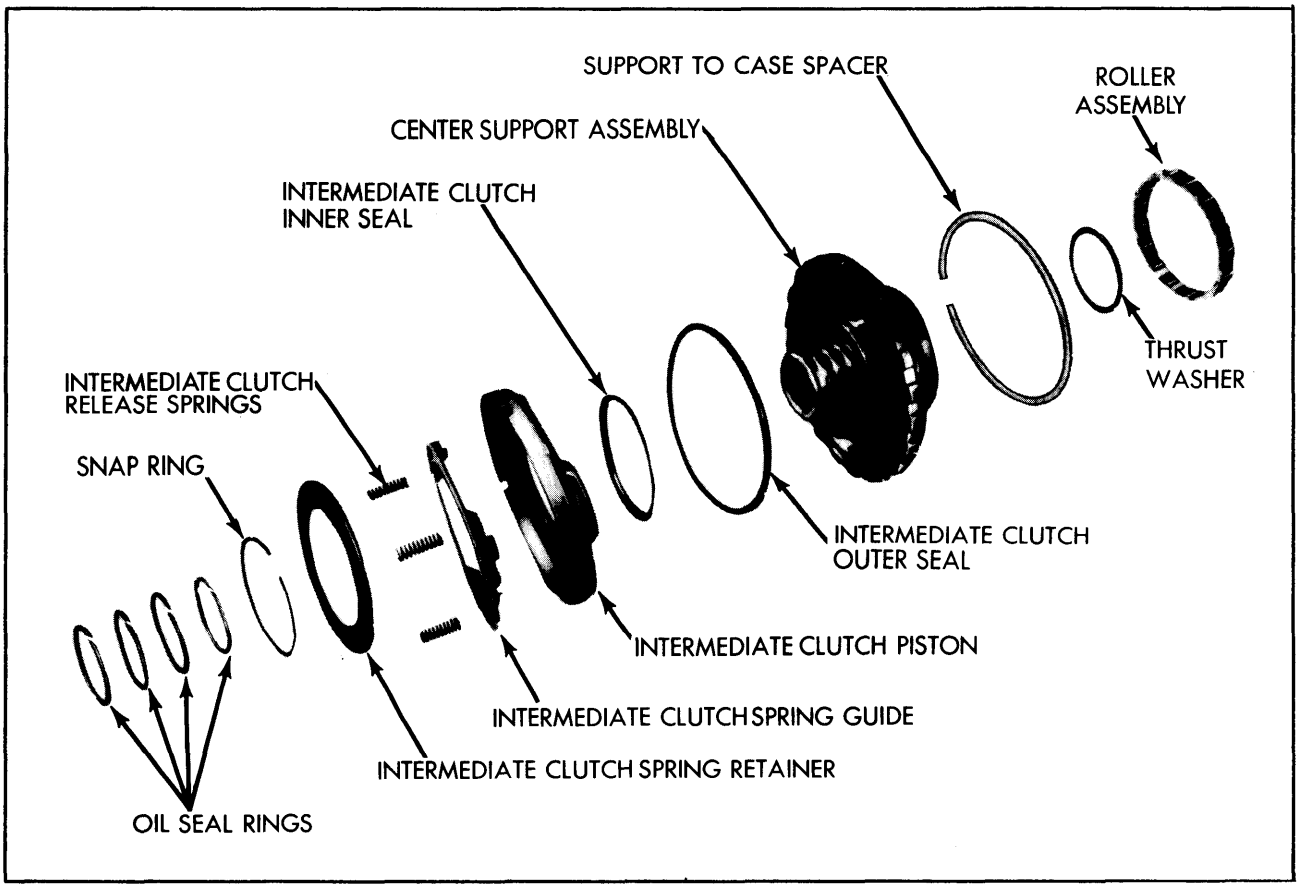


Fig. 7-72 Center Support Assembly—Disassembled View

2. Inspect bushing for scoring, wear or galling.
3. Check oil ring grooves for damage.
4. Air check oil passages to be sure they are open and not interconnected.
5. Inspect piston sealing surfaces for scratches.
6. Inspect piston seal grooves for nicks or other damages.
7. Inspect piston for cracks.

(NOTE: Refer to Fig. 7-10 for identification of oil feed passages and lands.)

8. Inspect springs for collapsed coils or signs of distortion.
9. Inspect oil seal rings for damage.

(NOTE: All service center support oil seal rings are hook type cast iron.)

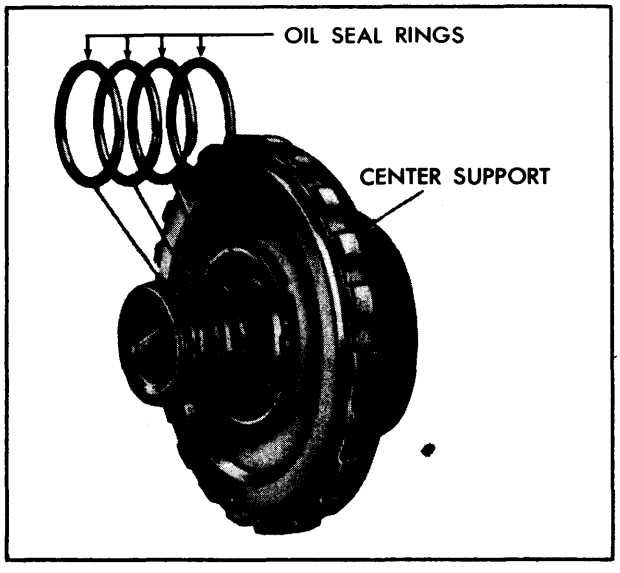


Fig. 7-73 Center Support Oil Seal Rings

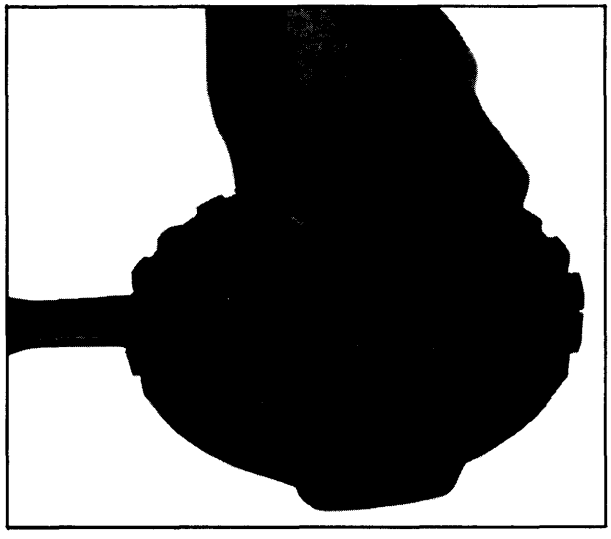


Fig. 7-74 Removing Intermediate Clutch Snap Ring

BACK TO INDEX

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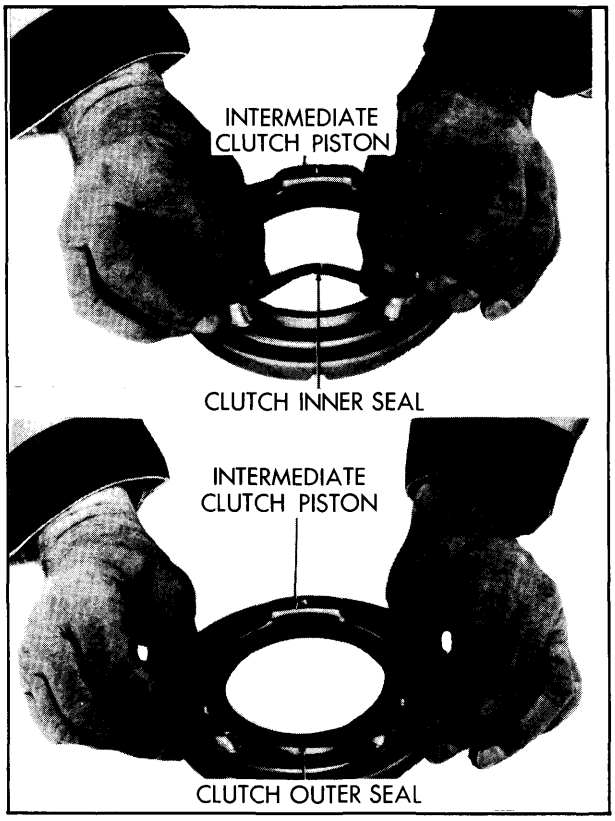


Fig. 7-75 Installing Intermediate Clutch Piston Seals

10. Inspect to see that constant bleed orifice (approx. .020) is open, Fig. 7-41.

c. Assembly

1. Lubricate new inner and outer clutch piston seals with transmission fluid. Lubricate seal grooves in intermediate clutch piston and install seals with lips facing away from spring guide, Fig. 7-75.
2. Place Intermediate Clutch Inner Seal Protector, J-21363, over center support hub, Fig. 7-76, and install intermediate clutch piston, making certain it fully seats in center support. Remove J-21363.
3. Install plastic spring guide, Fig. 7-77.

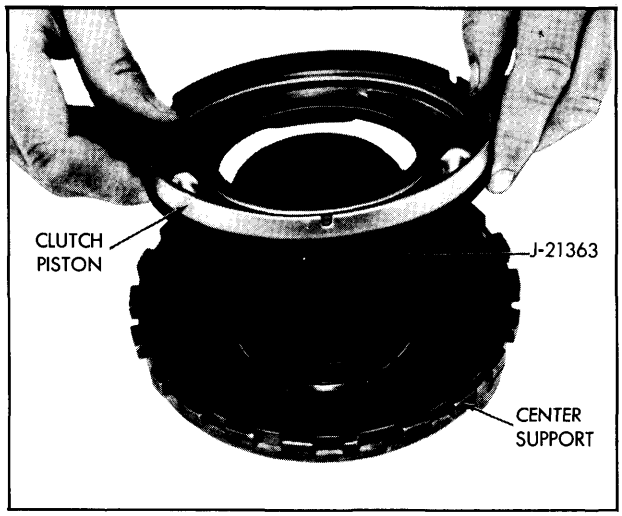


Fig. 7-76 Installing Intermediate Clutch Piston

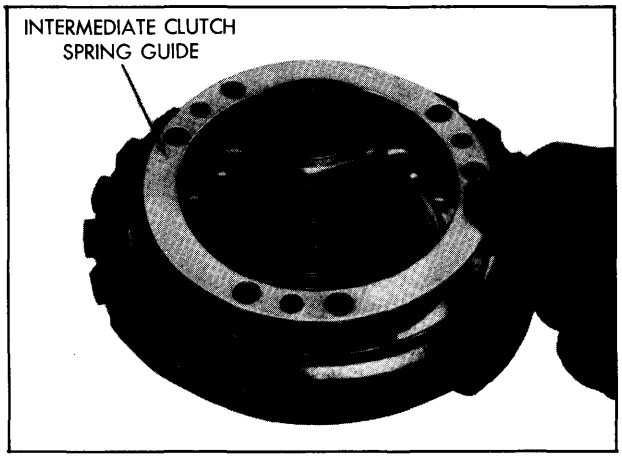


Fig. 7-77 Installing Spring Guide

4. Install 3 clutch release springs, space equally, into holes in spring guide, Fig. 7-78.
5. Place spring retainer and snap ring over springs.
6. Compress spring retainer, being careful that retainer does not get caught in snap ring groove, and install snap ring with Snap Ring Pliers, J-8059 or J-5586, Fig. 7-74.
7. Install four oil seal rings on the center support, Fig. 7-73.
8. Air check operation of intermediate clutch piston. Apply air through center oil feed hole to actuate clutch pistons, Fig. 7-79.

43. Gear Unit (Fig. 7-80)

a. Disassembly of Gear Unit

1. Using Adapter, J-21364, in Rear Unit Holding Fixture, J-6116-01, place gear unit in Holding Fixture with output shaft pointing downward.
2. Remove center support to sun gear races and thrust bearing.

(NOTE: Outer race may have stuck to center support when it was removed.)

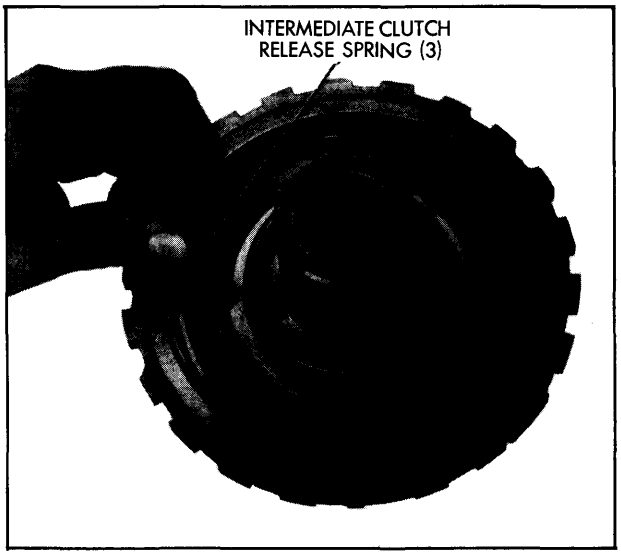


Fig. 7-78 Installing Clutch Release Springs

BACK TO INDEX

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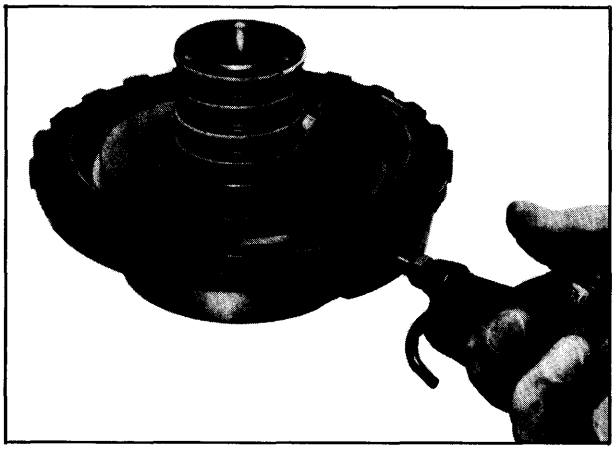


Fig. 7-79 Air Checking Intermediate Clutch

3. Remove sun gear from output carrier assembly.
4. Remove reaction carrier to output carrier thrust washer and front internal gear ring.
5. Invert gear unit in Holding Fixture with main shaft pointing downward.
6. Remove snap ring securing output shaft to output carrier and remove output shaft. Remove O-ring from output shaft and discard.
7. Remove thrust bearing and races from rear internal gear.
8. Lift rear internal gear and main shaft out of output carrier and remove thrust bearing and races from inner face of rear internal gear.
9. Remove snap ring from end of main shaft and remove rear internal gear.
10. Remove output carrier from Holding Fixture.

b. Inspection of Output Shaft

1. Inspect bushing for wear or galling.
2. Inspect bearing and thrust washer surfaces for damage.
3. Inspect governor drive gear for rough or damaged teeth.
4. Inspect splines for damage.
5. Inspect drive lugs for damage.
6. Inspect speedometer drive gear for rough or damaged teeth. If replacement of drive gear is necessary, proceed as follows:

c. Speedometer Drive Gear Removal and Installation

(NOTE: The nylon speedometer drive gear is installed at the factory only. All service replacement drive gears are steel. If the occasion should arise when the nylon gear is required to be removed for inspection of the shaft or gear only, it may be removed and rein-

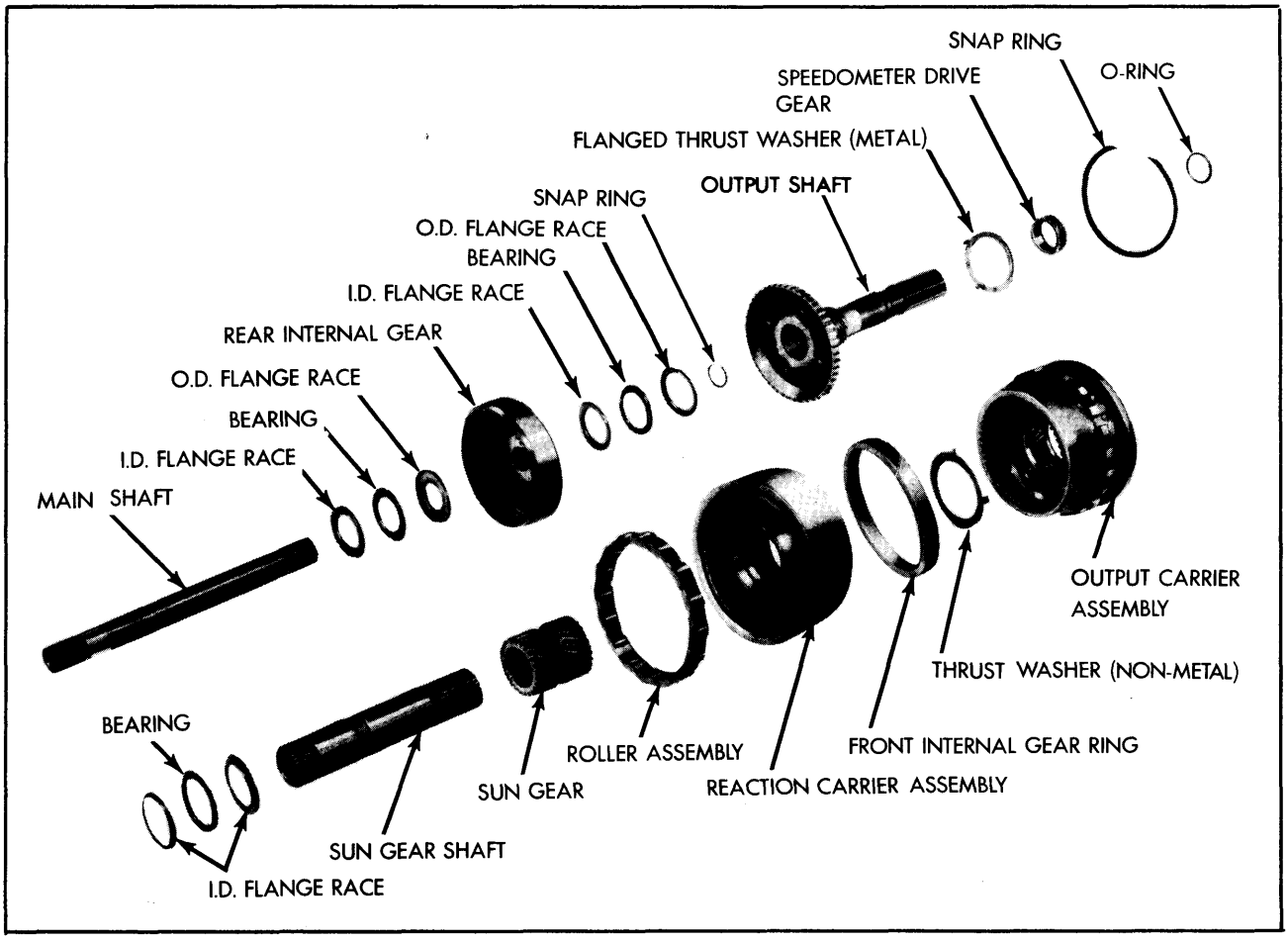


Fig. 7-80 Gear Unit—Disassembled View

BACK TO INDEX

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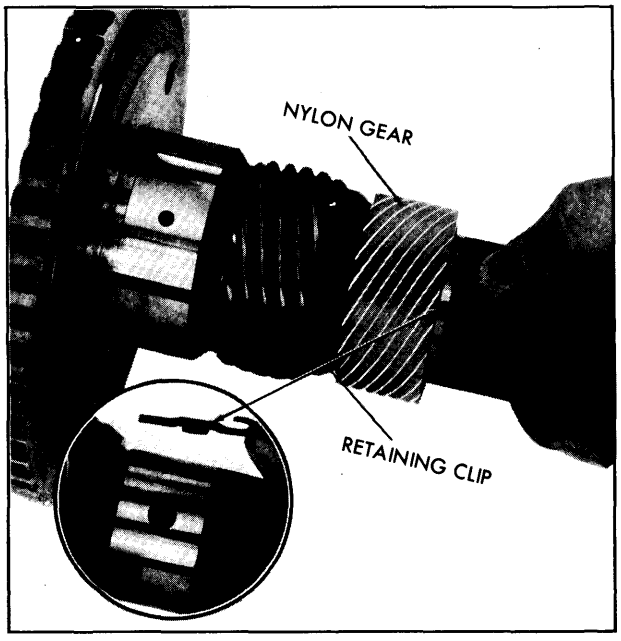


Fig. 7-81 Removing Nylon Speedometer Drive Gear

stalled using steps 1 and 2 immediately below. In all other cases, see Speedometer Drive Gear Replacement.)

1. Depress retaining clip and slide gear off output shaft, Fig. 7-81.
2. Place retaining clip (square end toward flange of shaft) into hole in output shaft, Fig. 7-81. Align slot in speedometer drive gear with retaining clip and install gear.

d. Speedometer Drive Gear Replacement

1. If nylon gear is on shaft, depress retaining clip and slide gear off output shaft, Fig. 7-81. Discard retaining clip.
2. If steel gear is on shaft:

a. Install Speedometer Drive Gear Remover, J-21427-01, with Pulley Puller, J-8433, and attach, using Speedometer Drive Gear Remover Bolts, J-21797, on output shaft so that puller bolt indexes with end of shaft and flat face of remover tool is under front face of drive gear.

b. Tighten bolt on Pulley Puller, Fig. 7-82, until gear is free on shaft. Remove tools and gear from shaft.

3. Support output shaft and install new steel speedometer drive gear using a piece of pipe.

CAUTION: Use a pipe that closely fits output shaft and does not contact gear teeth. Contact with gear teeth would result in damage to the gear as it is driven into place.

4. Drive gear onto shaft until distance from rear face of gear to end of output shaft is 15 inches, Fig. 7-83.

e. Inspection of Main Shaft

1. Inspect shaft for cracks or distortion.
2. Inspect splines for damage.
3. Inspect ground bushing journals for damage.
4. Inspect snap ring groove for damage.

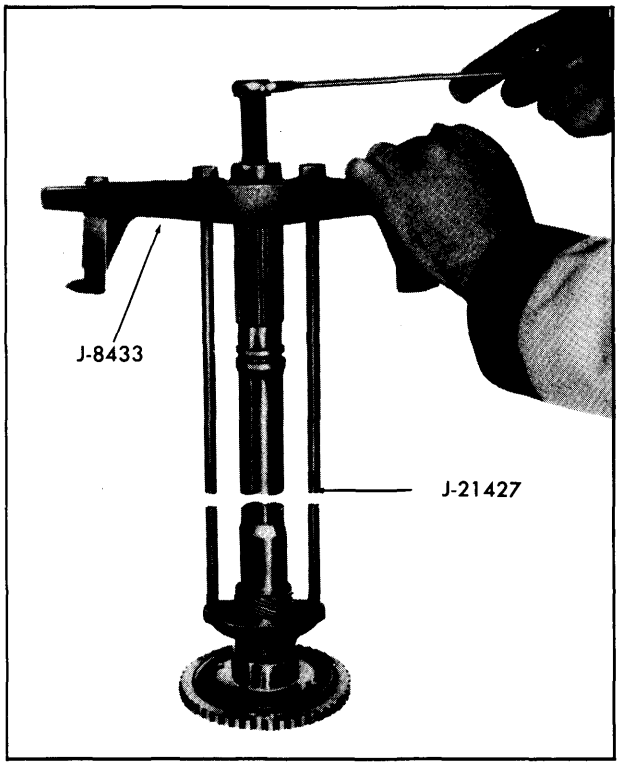


Fig. 7-82 Removing Steel Speedometer Drive Gear

5. Make sure lubrication holes are open.

f. Inspection of Rear Internal Gear

1. Inspect gear teeth and bearing surfaces for damage or wear.

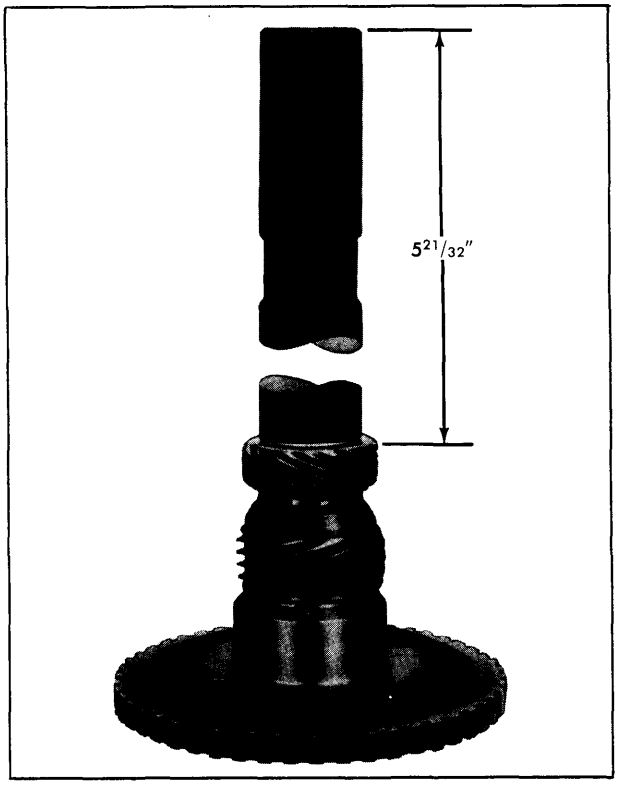


Fig. 7-83 Installing Steel Speedometer Drive Gear

BACK TO INDEX

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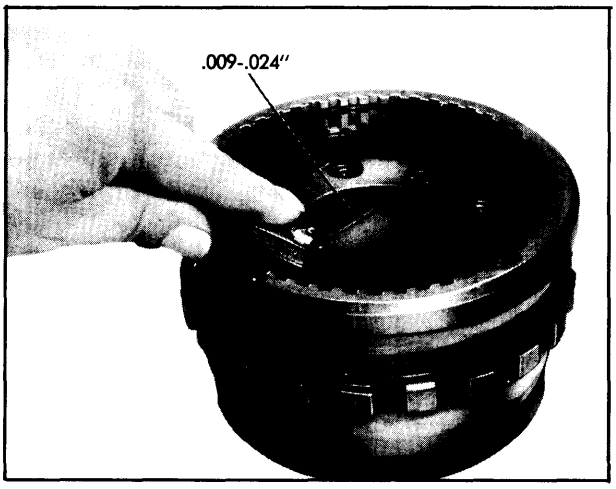


Fig. 7-84 Checking Output Carrier Pinion End Play

2. Inspect splines for damage.
3. Inspect gear for cracks.

g. Inspection of Output Carrier Assembly

1. Inspect front internal gear for damaged teeth.
2. Inspect pinion gears for damage, rough bearings or tilt.
3. Check pinion end play. Pinion end play should be .009 inch-.024 inch, Fig. 7-84.
4. Inspect parking gear lugs for cracks or damage.
5. Inspect output shaft locating splines for damage.
6. Inspect front internal gear ring for flaking or cracks.

h. Inspection of Reaction Carrier Assembly

1. Inspect band surface on reaction carrier for signs of burning or scoring.
2. Inspect roller clutch outer cam for scoring or wear.
3. Inspect thrust washer surfaces for signs of scoring or wear.
4. Inspect bushing for damage. If bushing is damaged, carrier must be replaced.
5. Inspect pinion gears for damage, rough bearings or excessive tilt.
6. Check pinion end play. Pinion end play should be .009 inch-.024 inch.

i. Pinion Gear Replacement—Reaction and Output Carrier Assemblies

1. Support carrier assembly on its FRONT face.
2. Using a 1/2 inch diameter drill, remove stake marks from the end of the pinion pin, or pins, to be replaced. This will reduce the possibility of cracking the carrier when pinion pins are pressed out.

CAUTION: Do not allow drill to remove any stock from the carrier as this will weaken the part and could result in a cracked carrier.

3. Using a tapered punch, drive or press pinion pins out of carrier.
4. Remove pinion gears, thrust washers, and roller needle bearings.
5. Inspect pinion pocket thrust faces for burrs and remove if present.
6. Install eighteen needle bearings into each pinion gear using petrolatum to hold bearings in place. Use a pinion pin as a guide.
7. Place a bronze and steel thrust washer on each side of pinion gear with steel washers against gear, Fig. 7-85. Hold washers in palce with petrolatum.
8. Place pinion gear assembly in position in carrier and install a pilot shaft through rear face of assembly to hold parts in place.

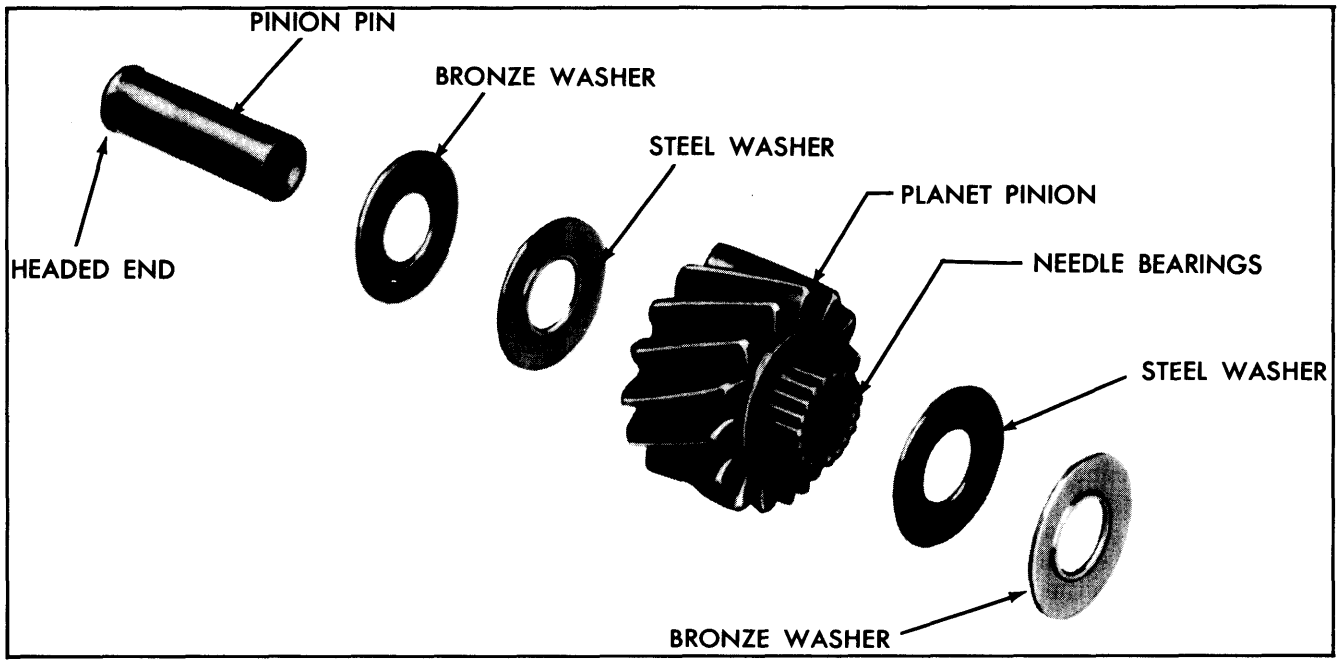


Fig. 7-85 Planet Pinion—Disassembled View

BACK TO INDEX

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Fig. 7-86 Staking Pinion Pin

9. Drive a new pinion pin into place from the front, while rotating pinion gear. Be sure that headed end is flush or below face of carrier.

10. Using a punch and bench vise for an anvil, stake opposite end of pinion pin in three places with a blunt radius chisel, Fig. 7-86.

CAUTION: Both ends of pinion pins must lie below face of carrier or interference may occur.

11. Repeat installation procedure for each pinion gear.

j. Inspection of Roller Clutch Assembly

1. Inspect roller clutch for damaged rollers or springs.
2. Inspect roller clutch cage for damage.

k. Inspection of Sun Gear

1. Inspect gear teeth for damage or wear.
2. Inspect splines for damage.
3. Be sure oil lubrication hole is open.

l. Inspection of Sun Gear Shaft

1. Inspect shaft for cracks or splits.
2. Inspect splines for damage.
3. Inspect bushings for scoring or galling.
4. Inspect ground bushing journals for damage.
5. Be sure oil lubrication hole is open.

m. Assembly of Complete Gear Unit

1. Install rear internal gear on end of mainshaft that has snap ring groove and install snap ring.
2. Install races and thrust bearing on inner face of rear internal gear, retaining races and bearing with petrolatum. Proceed as follows:
   a. Install large diameter race first, with flange facing up, Fig. 7-87.
   b. Install thrust bearing in race.
   c. Install small diameter race on bearing with inner flange facing down.

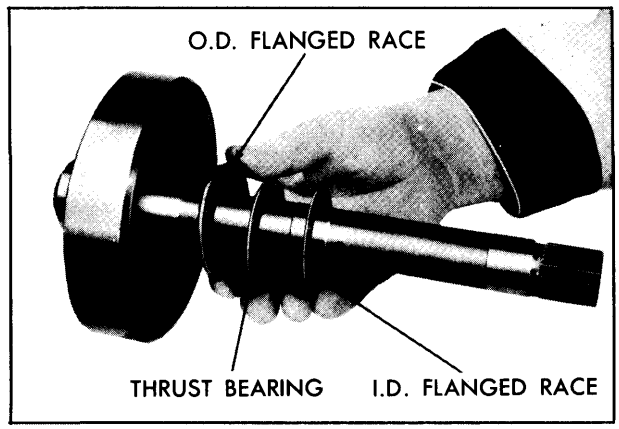


Fig. 7-87 Installing Rear Internal Gear-to-Sun Thrust Bearing and Races

3. Lubricate pinion gears in output carrier with transmission fluid and install output carrier on mainshaft so that pinion gears mesh with rear internal gear.
4. Place assembly in Rear Unit Holding Fixture, J-6116-01, with mainshaft pointing downward. Be careful not to damage shaft.
5. Install races and thrust bearing on outer face of rear internal gear, retaining races and bearing with petrolatum. Proceed as follows:
   a. Install small diameter (flanged I.D.) race first, with flange facing up, Fig. 7-88.
   b. Install thrust bearing in race.
   c. Install large diameter (flanged O.D.) race on bearing with flange cupped over bearing.
6. Install output shaft into output carrier and install snap ring. Install new O-ring on output shaft.
7. Invert assembly in Holding Fixture with output shaft pointing downward.
8. Lubricate tab side of reaction-to-output carrier thrust washer with petrolatum and install thrust washer in output carrier with tabs in tab pockets, Fig. 7-89.

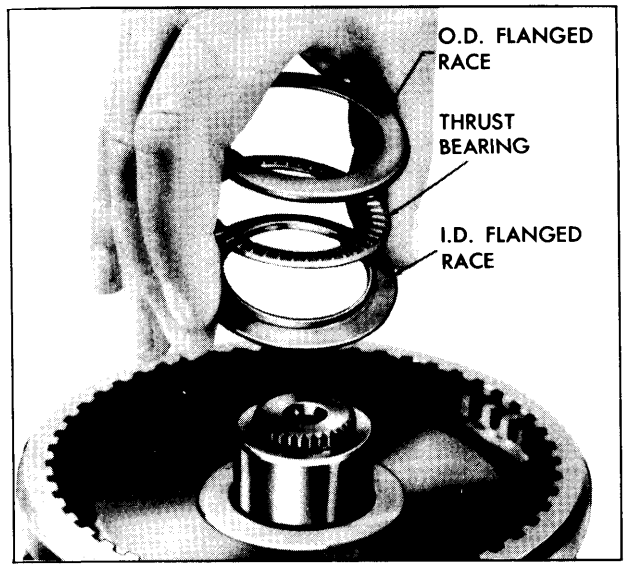


Fig. 7-88 Internal Gear, Thrust Bearing and Races

BACK TO INDEX

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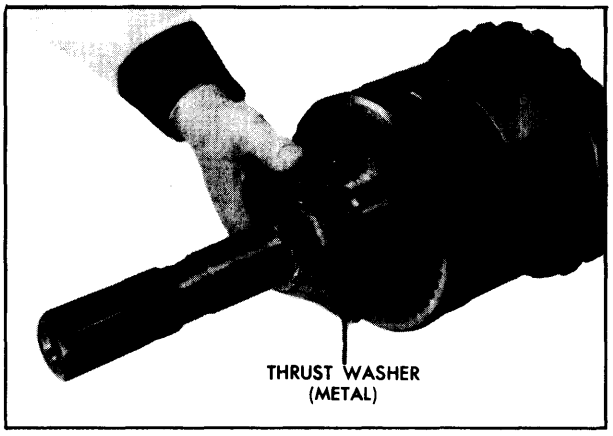


Fig. 7-89 Installing Case-to-Output Shaft Metal Thrust Washer

9. Install sun gear with end having chamfered I.D. facing down.

10. Install sun gear shaft with longer splined end down.

11. Install gear ring over output carrier.

12. Lubricate pinion gears in reaction carrier with transmission fluid and install reaction carrier on output carrier, Fig. 7-90, so that pinion gears mesh with front internal gear.

(NOTE: When a new output carrier and/or reaction carrier is being installed, and if the front internal gear ring prevents assembly of the carriers, replace the front internal gear ring with the service ring. The front internal gear ring is a selective fit at the factory but not in service.)



Fig. 7-90 Installing Reaction Carrier to Output Carrier

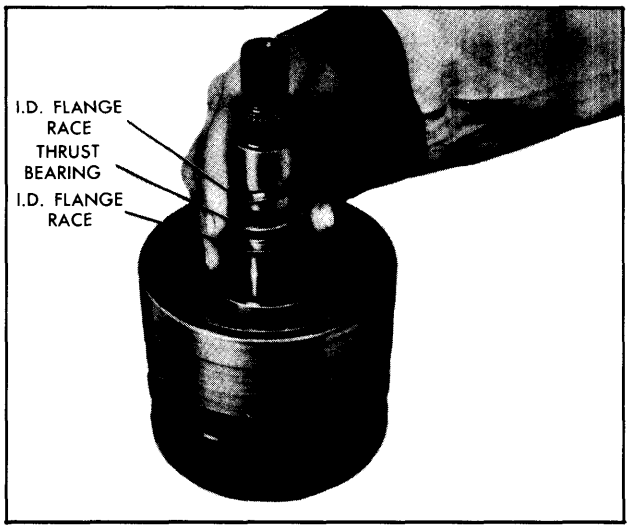


Fig. 7-91 Installing Center Support Thrust Bearing Over Sun Gear Shaft

13. Install large diameter O.D. race on sun gear with flange facing up against sun gear shaft.

14. Install thrust bearing on race.

15. Lubricate small diameter race with petrolatum and install race on center support with flange facing toward lower end, Fig. 7-91.

16. Lubricate reaction carrier to center support thrust washer with petrolatum and install washer in recess in center support, Fig. 7-41.

17. Install rollers that may have come out of roller clutch cage, by compressing energizing spring with forefinger and inserting roller from outer side, Fig. 7-92.

(NOTE: Make certain that energizing springs are not distorted, and that curved end leaf of springs are positioned against rollers.)

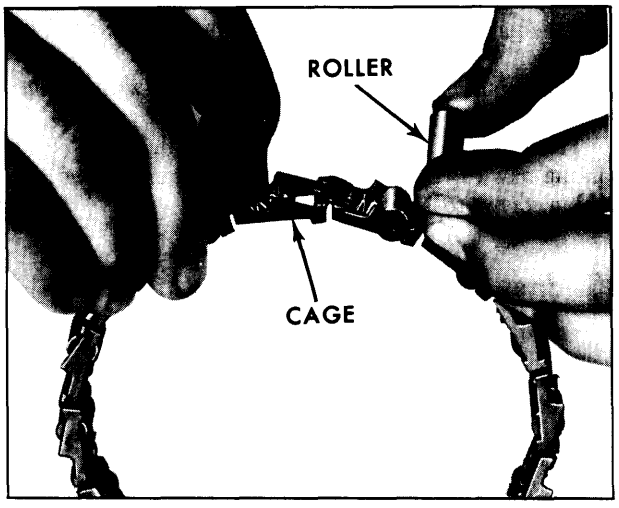


Fig. 7-92 Installing Rollers in Roller Clutch Cage

BACK TO INDEX

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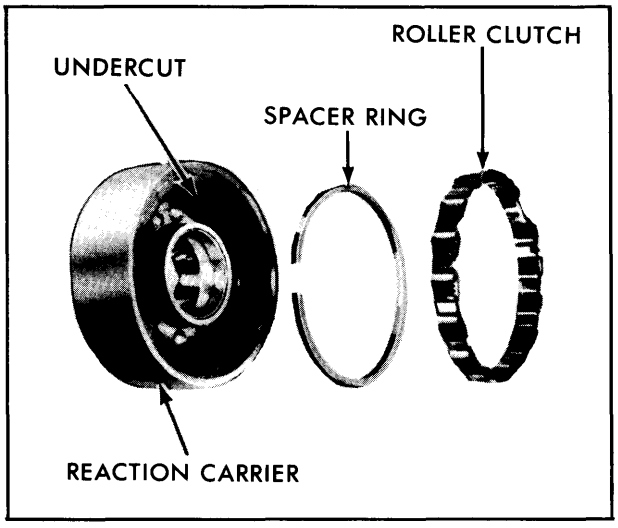


Fig. 7-93 Installing Spacer Ring and Roller Clutch Assembly

18. Install roller clutch assembly in reaction carrier, Fig. 7-93.

19. Install center support assembly into roller clutch in reaction carrier, Fig. 7-94.

(NOTE: Be sure that center support to reaction carrier thrust washer is in place before installing center support assembly into roller clutch in reaction carrier.)

(NOTE: With reaction carrier held, center support should turn counterclockwise only.)

20. Install Tool J-21365 or J-21795-02, on end of main shaft so that tangs engage groove in shaft. Tighten screw on tool to secure tool on shaft and prevent movement of the roller clutch during installation of the gear unit assembly.

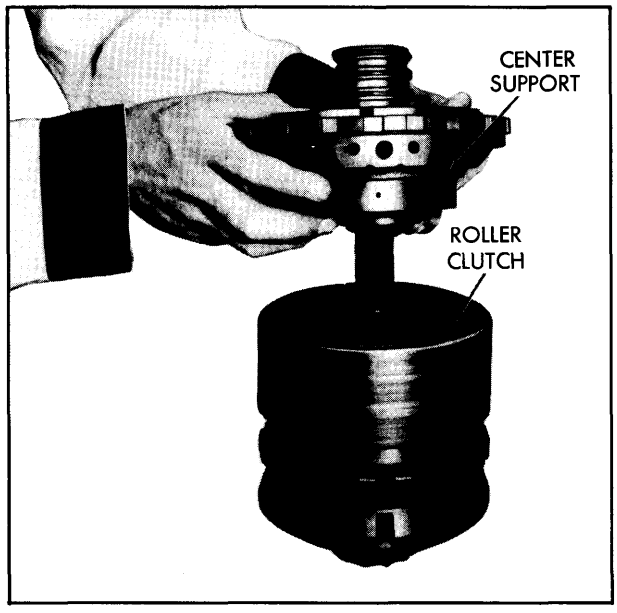


Fig. 7-94 Installing Center Support to Reaction Carrier

21. Remove gear unit from Holding Fixture and lay unit on its side. Install thrust metal washer on rear face of output shaft with bent tabs in tab pockets. Retain thrust washer with petrolatum, Fig. 7-89.

CAUTION: This must be a metal washer.

MAJOR TRANSMISSION COMPONENTS—INSTALLATION

44. Install Parking Pawl

1. Install parking pawl, tooth toward center of transmission, and install parking pawl shaft, Fig. 7-95.
2. Install parking pawl shaft retainer clip.
3. Install parking pawl shaft cup plug by driving into the transmission case, using a 3/8 inch diameter rod, until the parking pawl shaft bottoms on the case rib, Fig. 7-96.
4. Install parking pawl return spring with square end hooked on pawl.
5. Install parking pawl bracket with guides over parking pawl, Fig. 7-97. Install two attaching screws and tighten screws to 18 foot-pounds.

45. Install Support to Case Spacer Rear Band and Complete Gear Unit Assembly

1. Inspect rear band for cracks or distortion and band ends for damage at anchor lugs and apply lug. Also inspect lining for cracks, flaking, burning and looseness.
2. Install rear band assembly in transmission case so that band lugs index with anchor pins, Fig. 7-99.
3. Inspect support to case spacer for burrs or raised edges. If present, remove with a stone or fine sandpaper.
4. Install the support to case spacer against the shoulder at the bottom of case splines and the gap located adjacent to the band anchor pin.

CAUTION: Do not confuse this spacer (.040" *thick and both sides flat) with either the center support to case snap ring (one side beveled) or the backing plate to case snap ring (.093" thick and both sides flat).*

5. Install previously selected rear unit selective washer into slots provided inside rear of transmission case. Retain washer with petrolatum.

(NOTE: Proper washer size was determined at time of rear unit end play check Note 27.)

6. Place transmission case in Holding Fixture in horizontal position. Do not over-tighten transmission Holding Fixture side pivot pin as this will cause binding when gear unit is installed.
7. Install proper diameter length of pipe over output shaft to be used as a handle and to prevent spline damage to case bushing when installing gear unit assembly.

BACK TO INDEX

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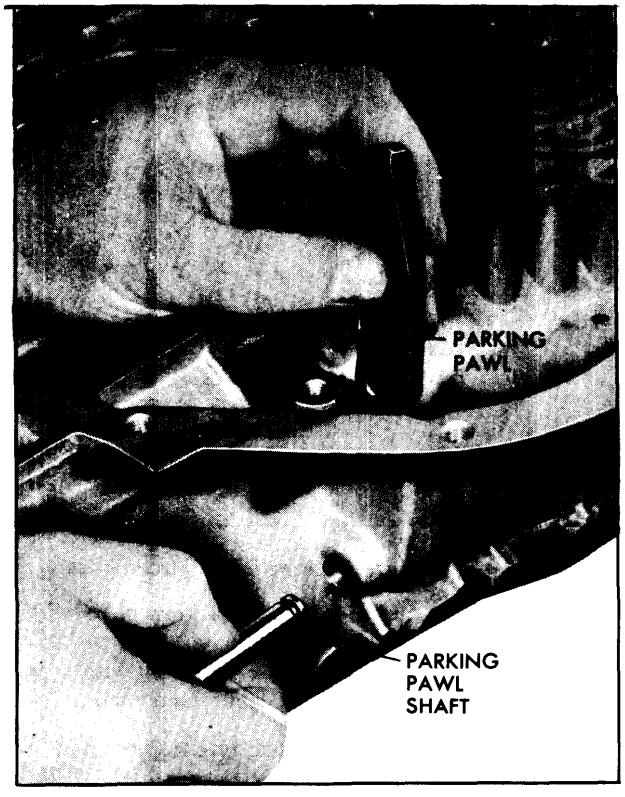


Fig. 7-95 Installing Parking Pawl and Shaft

CAUTION: Be careful not to drop or bump assembly in transmission case during installation. This could result in damage to output shaft case bushing as well as to assembly itself.

8. Install gear unit with center support and reaction carrier, by lining up slots and carefully guiding complete assembly horizontally into transmission case, making certain the center support bolt hole is properly aligned with hole in case.

9. Position transmission vertically with front end of case facing upward. Remove tool, J-21365 or J-21795-02.

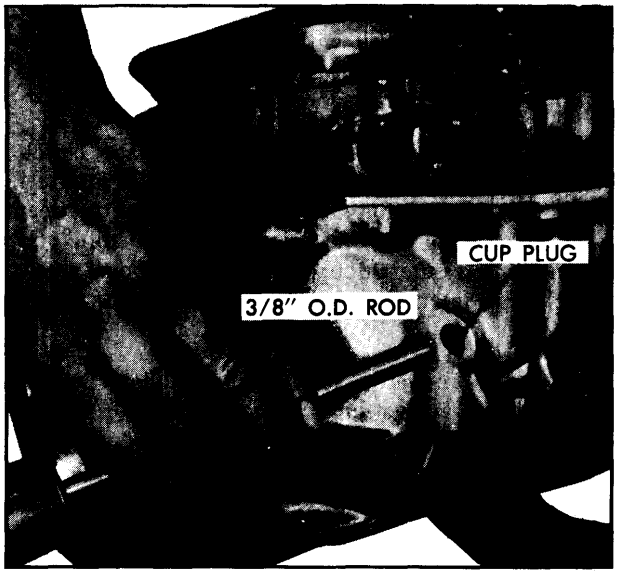


Fig. 7-96 Installing Cup Plug

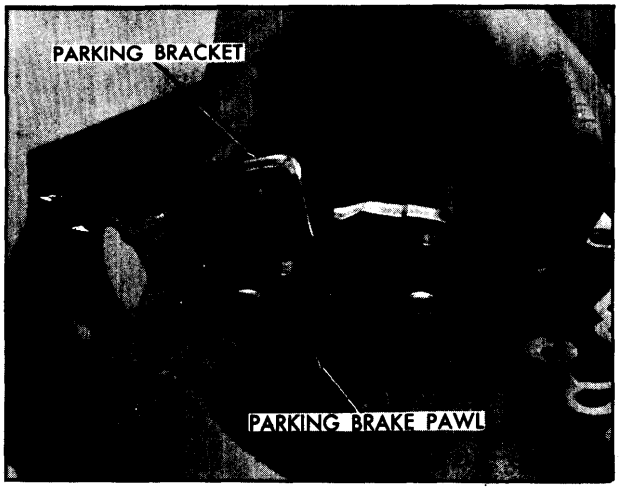


Fig. 7-97 Installing Parking Pawl Bracket

10. Lubricate center support to case snap ring with transmission fluid and install snap ring in transmission case with beveled side up, flat side against center support, locating gap adjacent to front band anchor pin, Fig. 7-98. Expand snap ring until center support is against shoulder of case.

11. Install case to center support bolt.

(NOTE: To correctly perform this operation, it will be necessary to use tool, J-23093 or to make the tool and follow the installation procedure described below.)

Make the tool from 3/8" (.375" diameter) cold roll steel or from a screwdriver with a 3/8" diameter shank. The stock should be approximately 12" long. Grind the stock to a blunt point, tapering it 7/8" from the end of the bar to a 1/8" diameter at the end, Fig. 7-100.

Bend the bar to a 45° angle 2-1/2" from the pointed end, Fig. 7-100.

Place the center support locating tool into the direct clutch passage in the case, with the handle of the tool pointing to the right as viewed from the front of the

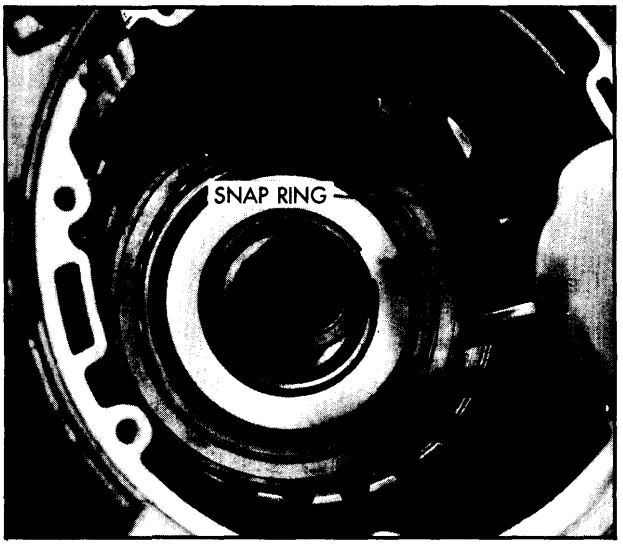


Fig. 7-98 Beveled Snap Ring Location

BACK TO INDEX

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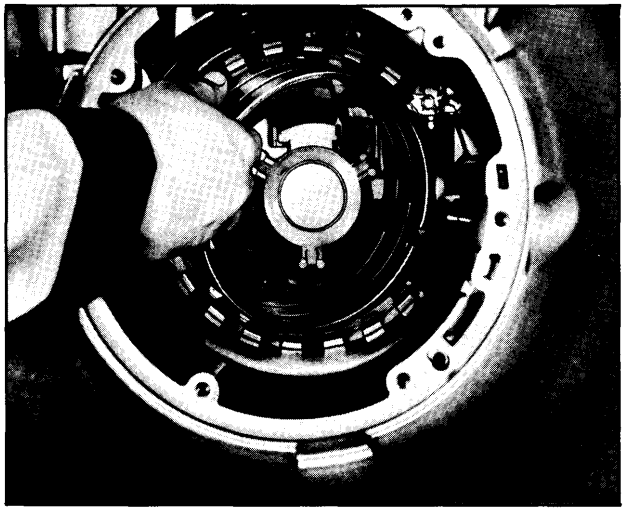


Fig. 7-99 Installing Rear Band Assembly

transmission and parallel to the bell housing mounting face.

Apply pressure downward on the tool handle, which will tend to rotate the center support counterclockwise as viewed from the front of the transmission. While holding the center support firmly counterclockwise against the case splines, torque the case-to-center support bolt to 23 ft. lbs. using a 3/8" thin wall deep socket.

CAUTION: When using the locating tool, take care not to raise burrs on the case valve body mounting face.

12. Before installing intermediate clutch plates, inspect plates for signs of burning, scoring, and wear.

13. Lubricate three steel and three composition faced intermediate clutch plates with transmission fluid and install clutch plates in transmission case, Fig. 7-101. Start with the waved steel plate and alternate composition faced and flat steel plates.

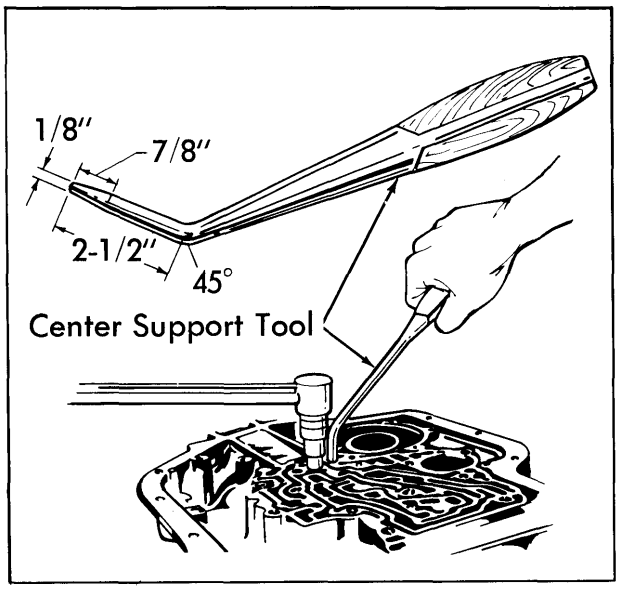


Fig. 7-100 Locating Center Support

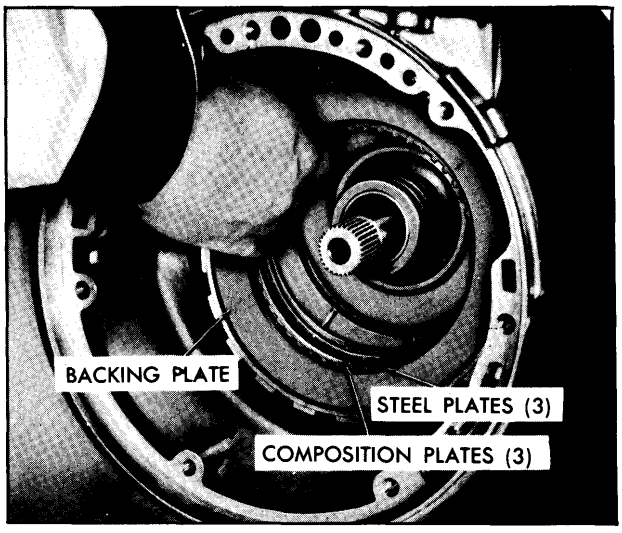


Fig. 7-101 Installing Intermediate Clutch Plates

14. Install intermediate clutch backing plate with flat machined surface against clutch plates.

15. Install backing plate to case snap ring with snap ring gap on side of case opposite front band anchor pin.

(NOTE: Both sides of the snap ring are flat and it is approximately .093" thick.)

16. Recheck rear unit end play as described in Note 27.

46. Install Front Band and Remaining Clutch Assemblies

1. Inspect front band for cracks or distortion and band ends for damage at anchor lug and apply lug. Also inspect lining for cracks, flaking, burning, and looseness.

2. Install front band with band anchor hole over band anchor pin, and apply lug facing servo hole, Fig. 7-102.

3. Install direct clutch housing and intermediate roller assembly. Make certain that clutch housing hub bottoms on sun gear shaft and splines on forward end of sun gear shaft are flush with splines in direct clutch housing. Clutch Alignment Tool J-24396 is available to position clutch plates for ease of installation.

(NOTE: It will be necessary to rotate clutch housing to allow roller outer race to index with intermediate clutch composition-faced plates. Removal of direct clutch composition and steel plates may be helpful and applying air pressure through the center support screw to apply the intermediate clutch plates may facilitate assembly.)

4. Install forward clutch hub to direct clutch housing thrust washer on forward clutch hub. Retain with petrolatum.

5. Position transmission horizontally in Holding Fixture and install forward clutch assembly and turbine shaft, Fig. 7-103. Make certain end of main shaft goes all the way into forward clutch hub. It will be necessary to rotate clutch housing to allow direct clutch driving hub to index with direct clutch composition plates. When

BACK TO INDEX

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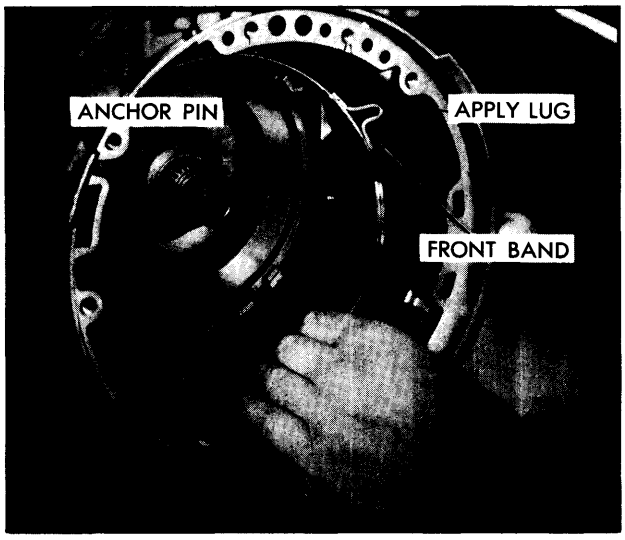


Fig. 7-102 Installing Front Band

forward clutch is seated, it will be approximately 1-1/4 inches from pump mounting face in case. Measure this distance.

(NOTE: Missing internal splines in forward clutch hub are lubrication passages and do not have to be indexed with any particular spline on main shaft.)

47. Install Oil Pump

1. Lubricate turbine shaft journals with transmission fluid and lubricate teflon oil rings on pump delivery sleeve with petrolatum.
2. Install Slide Hammer Bolts, J-6125-1, through two opposite unthreaded holes in pump assembly to serve as guide pins when installing pump.
3. Properly align pump to case gasket on case mounting face.
4. Position pump assembly in transmission case and thread Slide Hammer assemblies into their corresponding threaded holes in transmission case.
5. Install pump assembly in transmission case. Do not remove slide hammer bolts until last two pump attaching screws are installed.

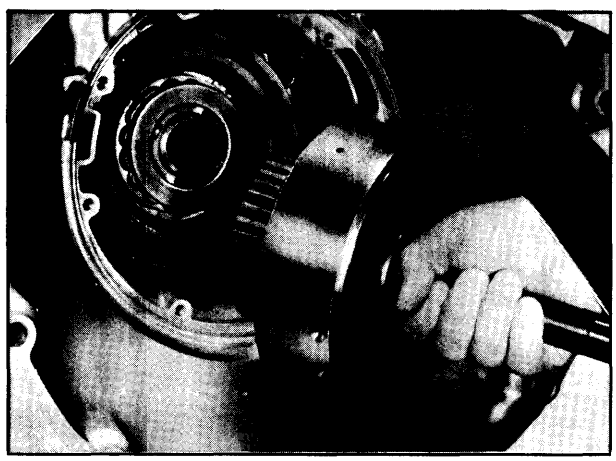


Fig. 7-103 Installing Forward Clutch Assembly

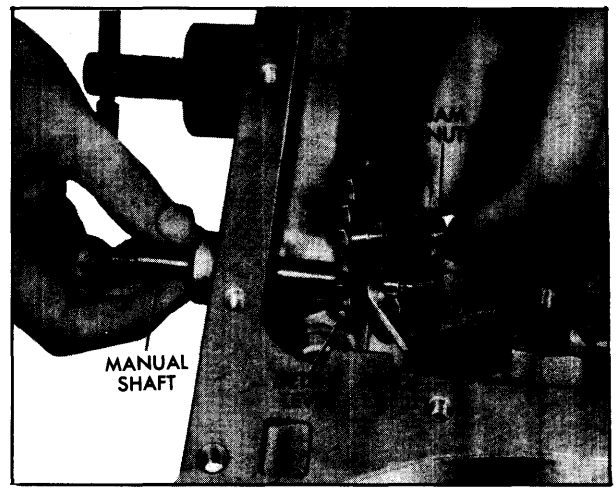


Fig. 7-104 Installing Manual Shaft

6. Using six new rubber-coated washers on pump attaching screws, install all but one attaching screw at either 5 o'clock or 10 o'clock position so that front unit end play can be rechecked. Tighten screws to 18 foot-pounds.

(NOTE: If turbine shaft cannot be rotated as pump is being pulled into place, the forward or direct clutch housings have not been installed properly to index with all the clutch plates. This condition must be corrected before pump is pulled fully into place.)

7. Recheck front unit end play as described in Note 24.
8. Install remaining pump attaching screw using new rubber coated washer. Tighten screw to 18 foot-pounds.
9. Apply non-hardening sealer to outside of new seal and install new front seal using Pump Oil Seal Installer, J-21359.

48. Install Parking Linkage, Detent Lever, and Manual Shaft

1. If necessary install a new manual shaft lip seal into transmission case using a 3/4" diameter rod to seat the seal.
2. Insert actuator rod into manual detent lever from side opposite pin.
3. Install actuator rod plunger under parking bracket and over parking pawl.
4. Install manual shaft into case and through detent lever, Fig. 7-104.
5. Install locknut on manual shaft. Tighten nut to 18 foot-pounds.
6. Install external manual yoke on manual shaft if removed. Tighten nut to 18 foot-pounds.
7. Install retaining pin in case, indexing it with groove in manual shaft, Fig. 7-105.

(NOTE: If procedure is being performed with transmission in car, install and straighten bent pin.)

BACK TO INDEX

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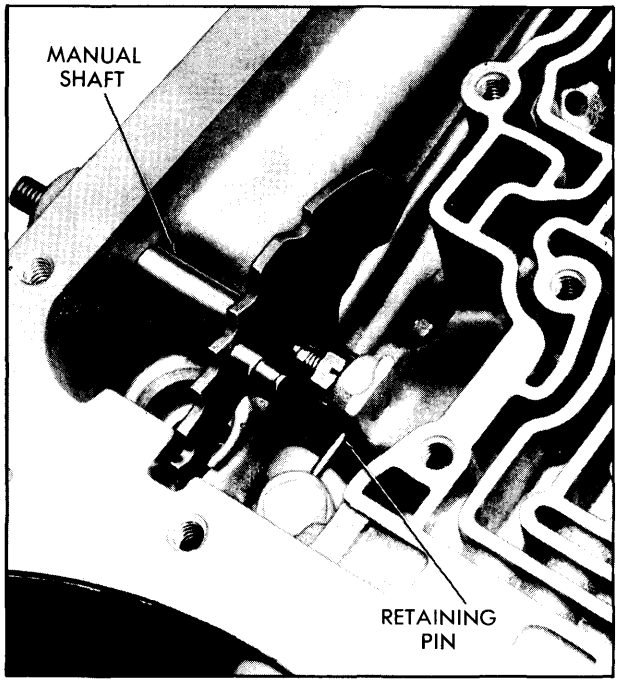


Fig. 7-105 Retaining Pin

49. Install Extension Housing

1. Install new gasket on extension housing, retaining with petrolatum.
2. Check O-ring on output shaft for any nicks or flattening and replace O-ring if either condition exists.
3. Secure extension housing to case with six attaching screws. Tighten screws to 23 foot-pounds.
4. If necessary, install a new extension housing oil seal using Oil Seal Installer, J-21359. Apply non-hardening sealer to outside of seal before installation.

50. Install Check Balls, Control Valve, Spacer Plate & Gaskets, Detent Solenoid, Front Servo Assembly and Electrical Connector

1. Install two control valve assembly attaching bolts with heads cut off as guide pins as shown in Fig. 7-110.
2. Install five check balls into ball seat pockets in transmission case. Fig. 7-106.

(NOTE: If transmission is in car, install check balls into ball seat pockets on spacer plate, Fig. 7-107.)

3. Install control valve spacer plate-to-case gasket (gasket with extension for detent solenoid and a "C" near front servo location).
4. Install control valve spacer plate.
5. Install detent solenoid gasket.
6. Install detent solenoid assembly with connector facing outer edge of case. Do not tighten bolts at this time.
7. Install front servo spring and spring retainer into transmission case.
8. Install retainer ring in front servo pin groove and

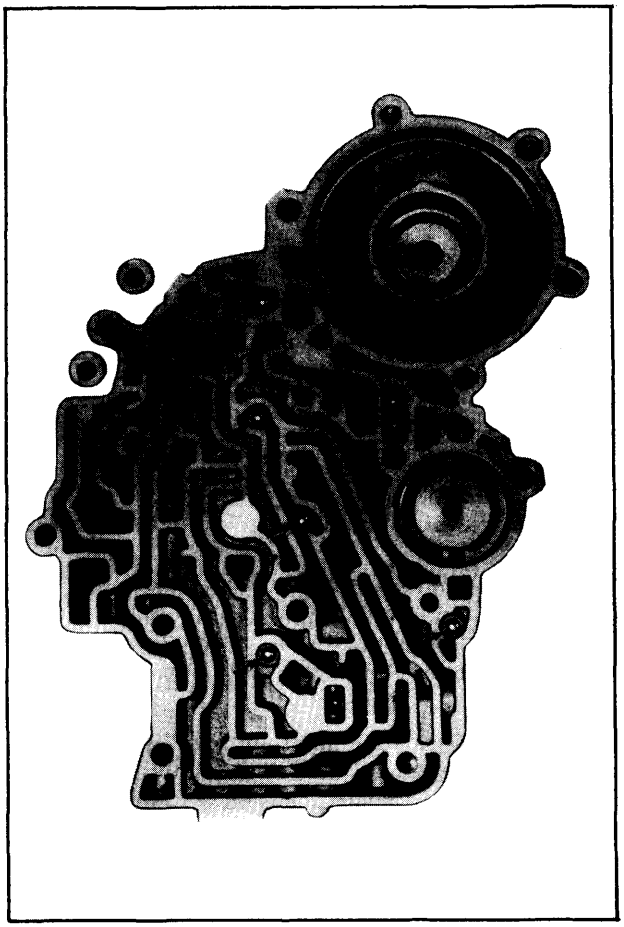


Fig. 7-106 Location of Check Balls

install pin into case so that tapered end contacts band. Make certain retainer ring is installed in servo pin groove.

9. Install seal ring on servo piston, if removed, and install on servo pin with flat side of piston positioned toward bottom pan.

(NOTE: The ring allows the front servo piston to slide very freely in the case. The free fit of the ring in

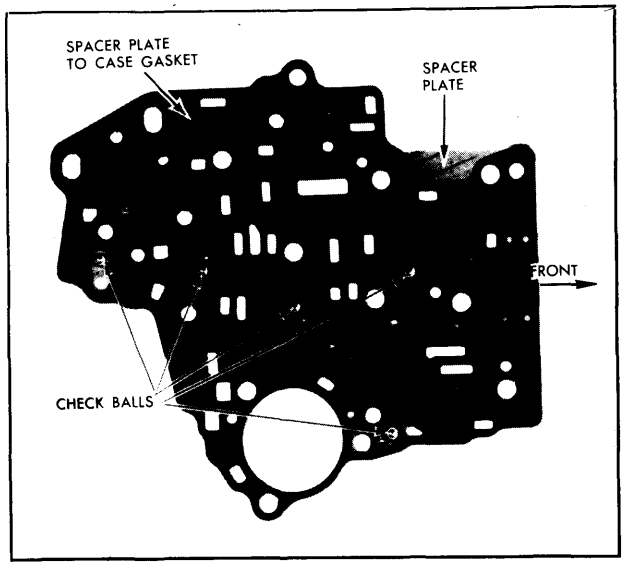


Fig. 7-107 Spacer Plate Gasket with Check Balls

BACK TO INDEX

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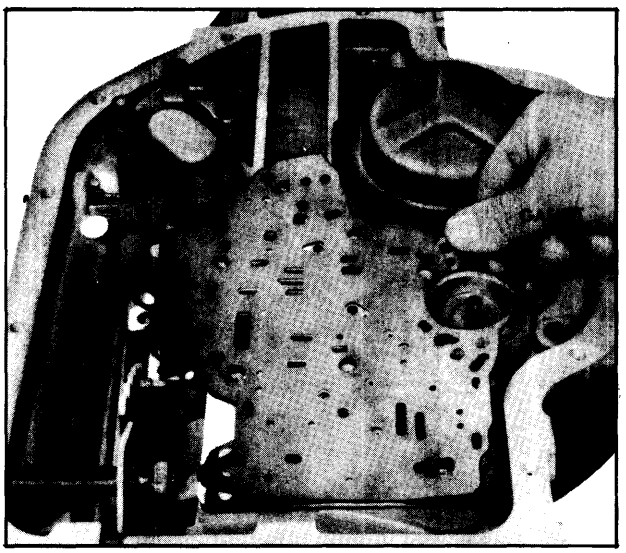


Fig. 7-108 Installing Spacer Gasket

ring in the bore is a normal characteristic and does not indicate leakage during operation. The teflon ring should only be replaced if it shows damage or if evidence of leakage during operation exists.)

(NOTE: If transmission is in car, assembly front servo group as shown in Figure 7-52 and install this group of parts into front servo bore in case and hold. Slip a length of straight, clean feeler gauge or shim stock (about .020") between spacer plate and front servo piston to temporarily retain front servo group.)

10. Install new O-ring on solenoid connector.
11. Install connector with lock tabs pointing into case. Position locator tab in notch on side of case.
12. Connect detent solenoid wire to connector terminal, Fig. 7-109.

51. Install Rear Servo Assembly

1. Lubricate inner and outer rear servo bores in transmission case with transmission fluid and install rear accumulator spring in servo inner bore.

(NOTE: Before installing rear servo assembly, make certain that rear band apply lug is aligned with servo pin bore in transmission case. Otherwise servo pin will not apply band.)

2. Position rear servo assembly in transmission.
3. Press down on rear servo assembly, making certain it is properly seated in case bore, and install rear servo cover and new gasket. Install six attaching screws, tightening screws to 18 foot-pounds.

52. Install Control Valve Assembly, Governor Pipes & Governor Screen Assembly

1. Install control valve assembly-to-spacer gasket (gasket with "VB" near front servo location).
2. Install governor pipes on control valve assembly. Governor pipes are interchangeable.
3. Install governor screen assembly, open end first; into governor feed pipe hole in case (hole nearest the center of transmission). Fig. 7-28.
4. Install control valve assembly and governor pipes on transmission, while carefully aligning the governor feed pipe over the governor screen, Fig. 7-110. Make certain gaskets and spacer do not become mispositioned. See Fig. 7-108.

(NOTE: Check manual valve to make sure it is indexed properly with pin on detent lever and governor pipes to make certain they are properly seated in case holes.)

5. Start control valve assembly attaching screws.

(NOTE: If transmission is in vehicle, remove feeler stock before tightening any control valve screws.)

6. Remove guide pins and install detent roller and spring assembly and remaining screws, Fig. 7-111. Torque bolts to 8 ft. lbs.
7. Tighten detent solenoid attaching screws to 10 foot-pounds. Solenoid screws should be zinc plated to provide a good electrical connection.

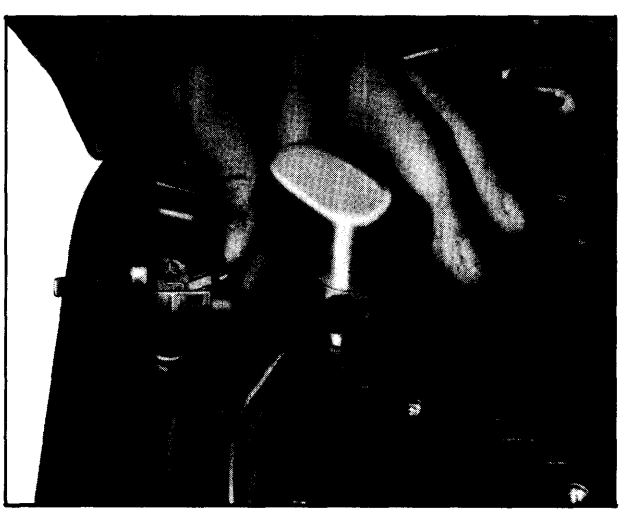


Fig. 7-109 Installing Wire onto Electrical Connector

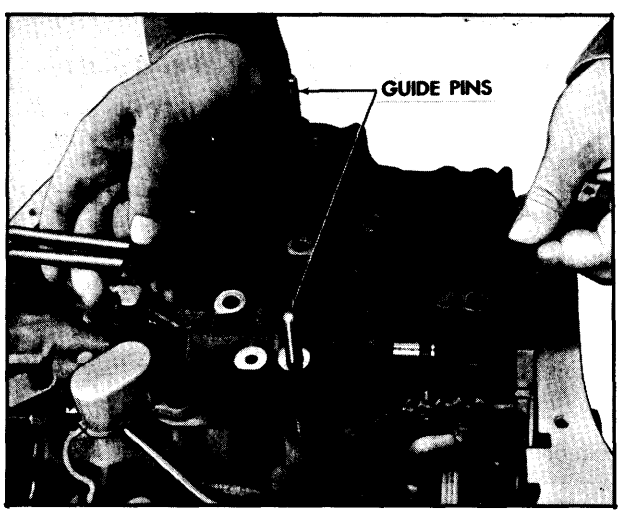


Fig. 7-110 Installing Control Valve Assembly

BACK TO INDEX

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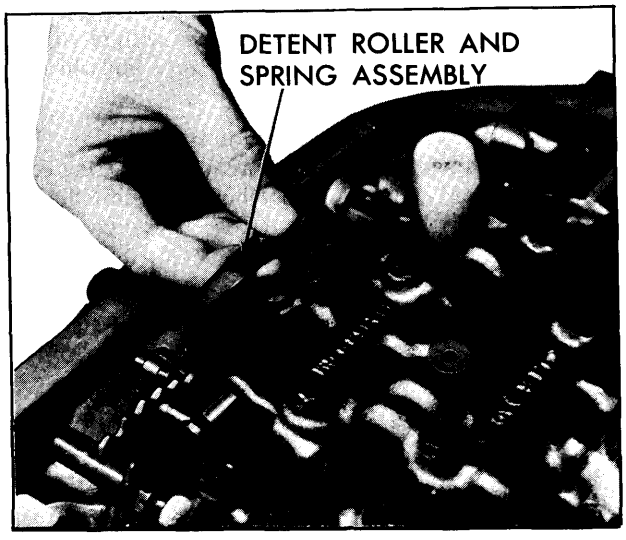


Fig. 7-111 Installing Detent Roller and Spring

53. Install Modulator Valve and Vacuum Modulator

1. Install modulator valve into case with stem end out.
2. Install new O-ring on vacuum modulator.
3. Install vacuum modulator into case with vacuum hose pipe facing front of car and angled 5° toward top of case.
4. Install modulator retainer with curved side of tangs, inboard and install attaching screw. Tighten screw to 18 foot-pounds.

54. Install Governor Assembly

1. Install governor assembly into case.
2. Using a new gasket, attach governor cover to case with four attaching screws. Torque screws to 18 foot-pounds.

(NOTE: If transmission is in car proceed as follows.)

3. Install two bolts securing transmission extension housing to cross member.

55. Install Speedometer Driven Gear Assembly and Trackmaster Speed Sensor

Series	Rear Axle Ratio	Driven Gear Teeth	Drive Worm Gear Teeth	Color of Driven Gear	Tire Size
Brougham Calais or DeVille	2.73:1	35	18	Pink	LR-78/B
	3.15:1	41	18	Yellow	
Limousine	3.15:1	40	18	Black	LR-78/D
Commercial Chassis	3.15:1	39	18	Brown	NR78/D

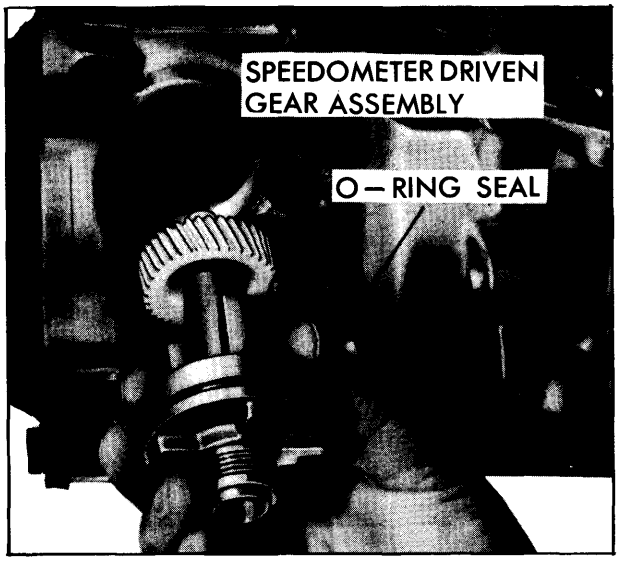


Fig. 7-112 Installing Speedometer Driven Gear

Speedometer driven gears are provided in three different tooth sizes. Driven gear and matching sleeve must be installed to correspond with axle ratio. Refer to chart above to select proper gear.

1. Lubricate driven gear selected from above chart with a small amount of DEXRON ® - II transmission fluid and position driven gear as shown in Fig. 7-112.
2. Install speedometer driven gear retainer with tangs in sleeve positioning bosses, and install attaching screw. Tightening screw to 18 foot-pounds.

CAUTION: Never turn sleeve in transmission case as shaft centerline is eccentric with outside diameter and gear damage will result.

56. Install Intake Pipe and Filter Assembly and Bottom Pan

2. Install filter and intake pipe assembly into case bore, Fig. 7-26.
3. Install filter retainer bolt, and tighten to 10 foot-pounds. Fig. 7-25.
4. Install new gasket on bottom pan and install bottom pan.
5. Install 13 bottom pan attaching screws. Tighten screws to 12 foot-pounds.

(NOTE: Intake pipe is marked "filter" and "case". Assemble "filter" end into filter.)

57. Install Converter

1. Install converter on turbine shaft making certain that converter drive hub slots are fully engaged with the pump drive gear tangs.
2. Install Converter Holding Clamp, J-21366, on front of transmission case, Fig. 7-20.

BACK TO INDEX

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TORQUE SPECIFICATIONS

Material Number	Application	Thread Size	Foot Pounds
260M	Filter to Valve Body Screw	5/16-18	10
280M	Solenoid to Case Screw	1/4-20	10
260M	Control Valve Assembly to Case Screw	1/4-20	8
		5/16-18	8
Special	Line Pressure Plug	1/8 Pipe	10
601M	Flywheel Housing Cover to Transmission Screw	1/4-20	5
280M	Pump Body to Cover Screw	5/16-18	18
280M	Pump Assembly to Case Screw	5/16-18	18
280M	Rear Servo Cover to Case Screw	5/16-18	18
260M	Governor Cover to Case	5/16-18	18
280M	Parking Pawl Bracket to Case Screw	5/16-18	18
260M	Vacuum Modulator Retainer to Case Screw	5/16-18	18
260M	Speedometer Driven Gear Retainer to Case Screw	5/16-18	18
1010-1020	Oil Pan to Case Screw	5/16-18	12
260M	Extension Housing to Case Screw	3/8-16	23
286M	Manual Shaft to Detent Lever Nut	3/8-24	18
286M	Manual Yoke to Manual Shaft Nut	3/8-16	18
300M	Case to Center Support Screw	3/8-16	23
300M	Flywheel to Converter Screw	3/8-16	30
280M	Transmission Case to Engine Screw	3/8-16	35
Steel	Oil Cooler Pipe Connector Nut at Case and Radiator	1/2-20	20
Steel	Cooler Pipe Connector at Case	1/4 Pipe	30
280M	Engine Rear Mount to Transmission	7/16-14	55
280M	Engine Rear Support Bracket to Frame Bolt	3/8-16	30

NOTE: Refer to back of Manual for bolt and nut markings and steel classifications.

BACK TO INDEX

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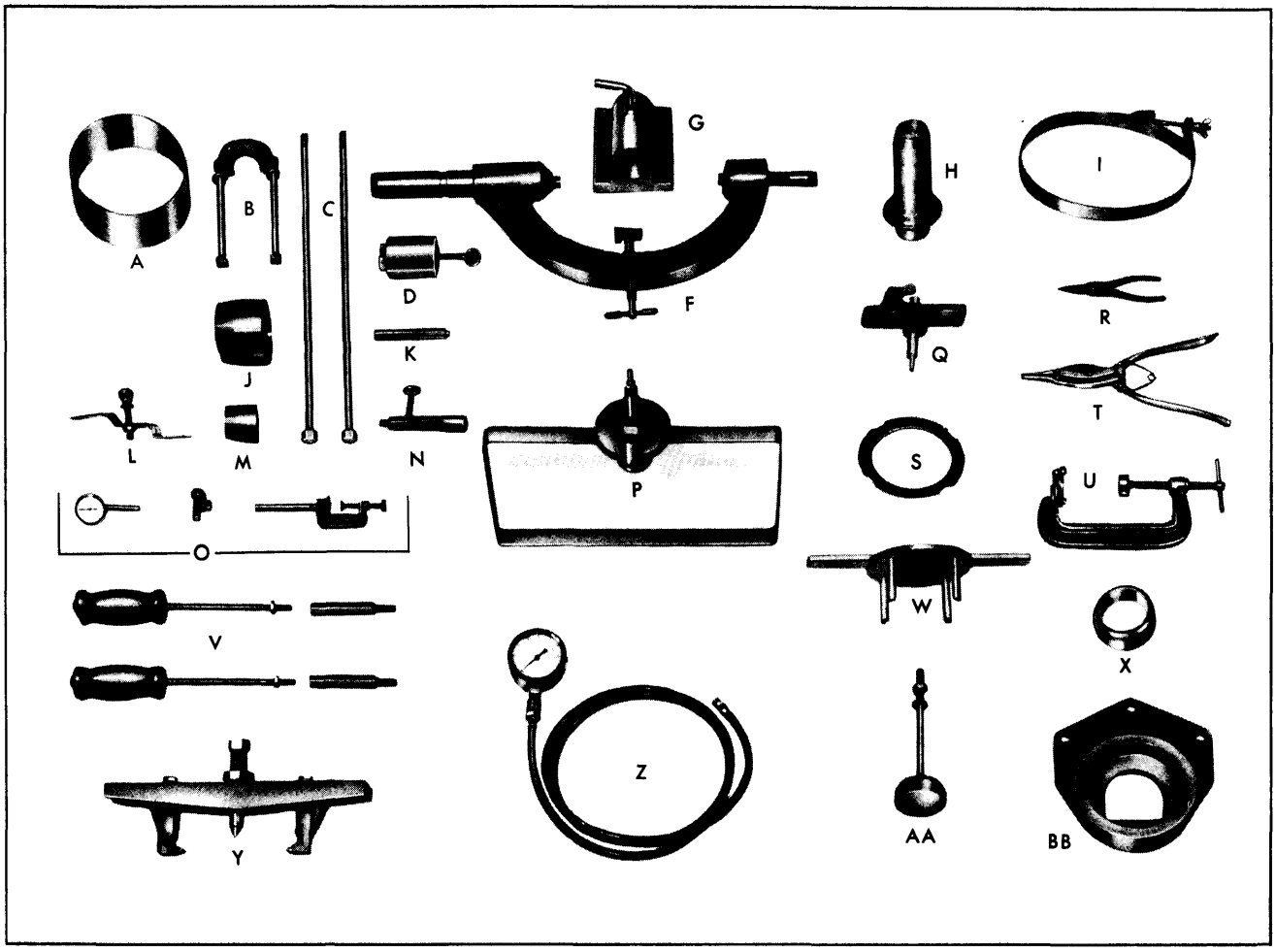


Fig. 7-113 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-21409	Forward and Direct Clutch Piston Installer	M	J-21362	Forward and Direct Clutch Inner Seal Protector
B	J-21427	Speedometer Drive Gear Remover	N	J-21361	Pump Check Valve Seat Remover
C	J-21797	Speedometer Drive Gear Remover Bolts	O	J-8001	Dial Indicator Set
D	J-21795	Gear Assembly Remover and Installer Adapter	P	J-21369	Converter Leak Test Fixture
F	J-8763-02	Transmission Holding Fixture	Q	J-21370	Band Apply Pin Selector Gage (Use J-21370-5 Pin)
G	J-3289-20	Holding Fixture Base	R	J-5403	Snap Ring Pliers (#21)
H	J-21359	Pump Oil and Extension Housing Seal Installer	S	J-21664	Clutch Spring Compressor Adapter
I	J-21368	Pump Body and Cover Alignment Band	T	J-8059	Snap Ring Pliers
J	J-21363	Intermediate Clutch Inner Seal Protector	U	J-21885	Control Valve Accumulator Piston Installer
K	J-21360	Pump Check Valve Seat Installer	V	J-6125	Slide Hammer Assemblies
L	J-21366	Converter Holding Clamp	W	J-4670	Clutch Spring Compressor
			X	J-21364	Rear Unit Holding Fixture Adapter
			Y	J-8433	Pulley Puller
			Z	J-5907	0-300 PSI Pressure Gage
			AA	J-6129	Rear Clutch Spring Compressor
			BB	J-6116	Rear Unit Holding Fixture

BACK TO INDEX

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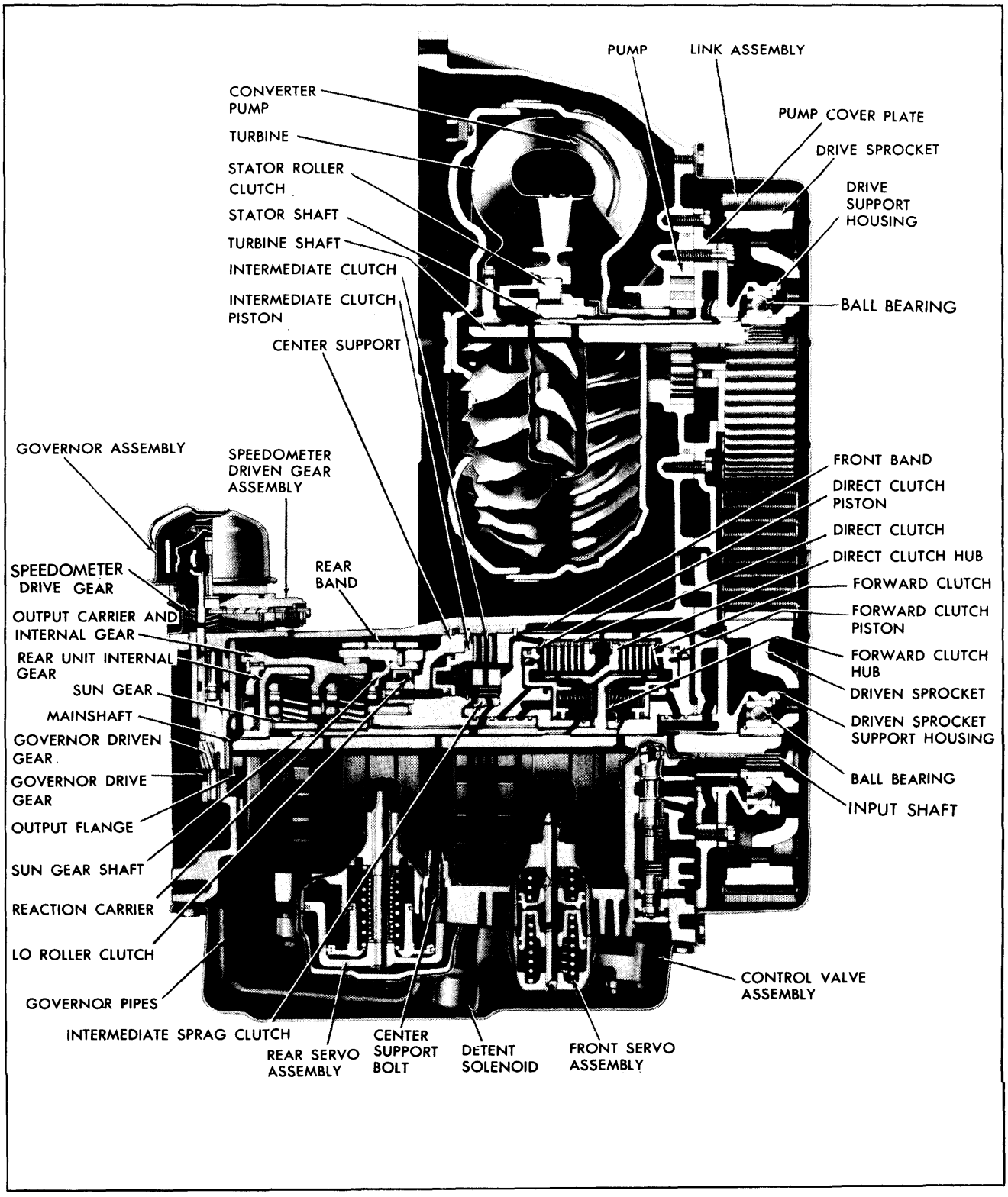


Fig. 7-115 Turbo Hydra-Matic Transmission-Cutaway View

(NOTE: The following information pertains only to the Eldorado.)

The model AJ on carburetor engine and AK for E.F.I. Turbo Hydra-matic transmission, Fig. 7-115, used on the Eldorado is a fully automatic transmission used for front wheel drive applications.

The 1976 transmission is similar to 1973. Refer to the 1973 shop manual for information pertaining to theory of operation, hydraulic system description, valve and hydraulic control functions and oil circuit diagrams.

BACK TO INDEX

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DIAGNOSIS

(NOTE: The following information is applicable to the Eldorado only. Where service procedures are similar to the Turbo Hydra-matic transmission used on other Cadillac models, reference will be made to the appropriate note in the forward part of this section.)

CAUTION: In the event of a major transmission malfunction, replace filter assembly and flush oil cooler and oil cooler lines.

It is particularly important in the case of a converter or pump malfunction to perform these service procedures.

Turbo Hydra-Matic 425 Diagnosis Procedure

The diagnosis procedures for the Turbo Hydra-matic transmission used on the Eldorado are identical to the procedures given for C-car, with the following exceptions:

1. Figures 7-116 through 7-120 are to be used in place of Figures 7-8 through 7-12, when diagnosing an Eldorado Turbo Hydra-matic transmission.
2. Transmission Noise - Sprocket and Link Assembly.

a. Link assembly too long. Sounds similar to pop corn popping. (There will be a rough burr along the teeth of the drive sprocket if the link assembly is too long). Replace sprocket and link assembly.

b. Drive or Driven sprocket teeth damaged.

c. Engine mounts worn or damaged.

Model AJ-AK Clutch Parts

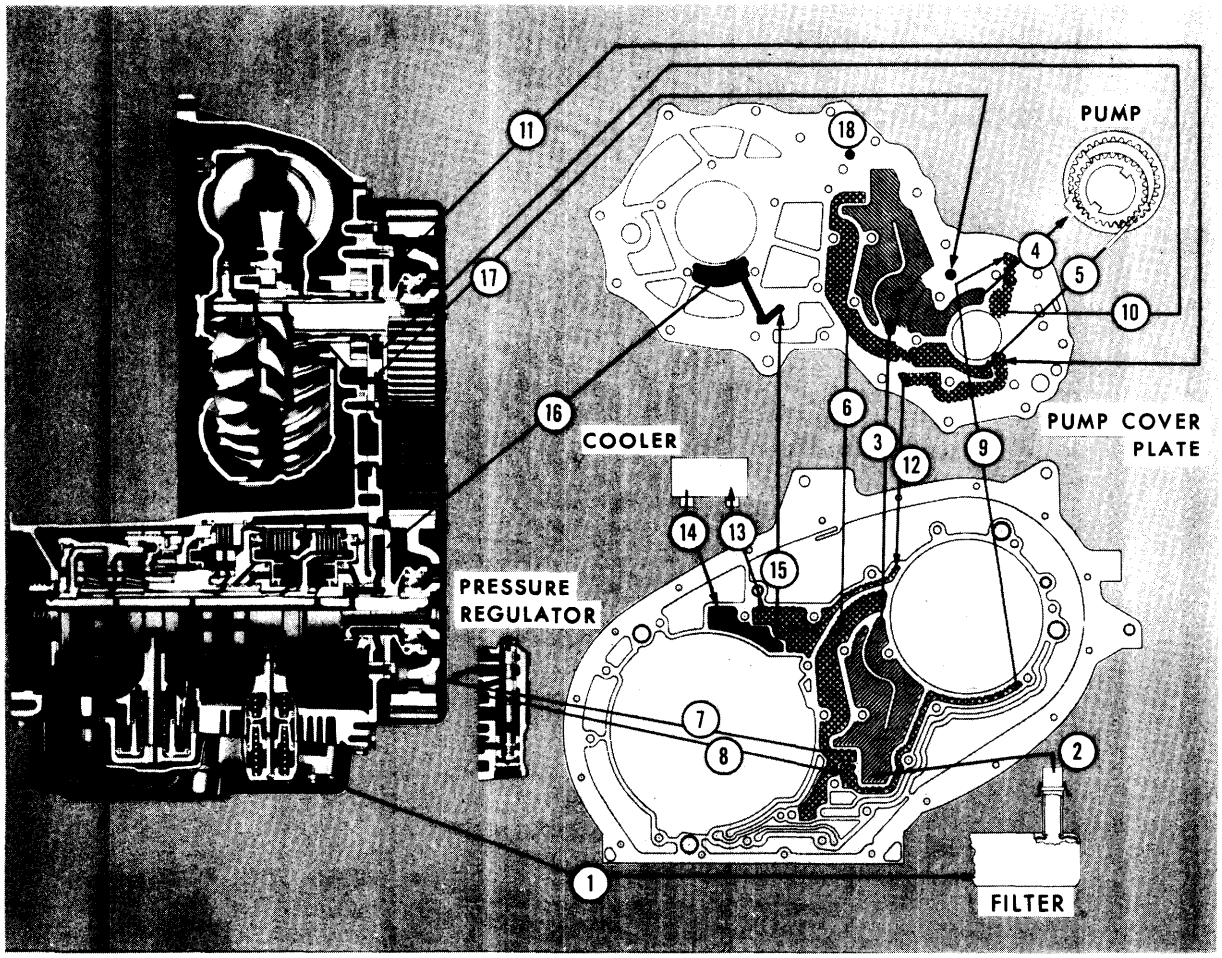
Clutch	No. of Flat Steel Clutch Plates	No. of Waved Steel Clutch Plates
Forward Clutch	5	*1
Direct Clutch	5	1
Intermediate Clutch	3	--

*Clutch Plate Dished

Clutch	No. of Clutch Composition Plates	No. of Piston Release Springs
Forward Clutch	5	16
Direct Clutch	6	14
Intermediate Clutch	3	6

BACK TO INDEX

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1 OIL FROM SUMP TO FILTER
2 FILTER TO CASE PASSAGE
3 CASE PASSAGE TO PUMP COVER PLATE PASSAGE
4 PUMP COVER PLATE PASSAGE TO PUMP
5 PUMP TO PUMP COVER PLATE PASSAGE
6 PUMP COVER PLATE PASSAGE TO CASE PASSAGE
7 CASE PASSAGE TO PRESSURE REGULATOR VALVE
8 PRESSURE REGULATOR VALVE TO CASE PASSAGE
9 CASE PASSAGE TO PUMP COVER PLATE PASSAGE
10 PUMP COVER PLATE PASSAGE TO CONVERTER
11 CONVERTER TO PUMP COVER PLATE PASSAGE
12 PUMP COVER PLATE PASSAGE TO CASE PASSAGE
13 CASE PASSAGE TO COOLER
14 COOLER RETURN TO CASE PASSAGE
15 CASE PASSAGE TO PUMP COVER PLATE PASSAGE
16 PUMP COVER PLATE PASSAGE TO TRANSMISSION POWER TRAIN (ALL INTERNAL LUBRICATION)
NOTE: THE NUMBERS IN THE CROSS SECTION INDICATE THAT THERE ARE ADDITIONAL LUBRICATION HOLES IN THIS AREA THAT ARE NOT SHOWN IN THE CROSS SECTION
17 FRONT SEAL DRAIN BACK HOLE
18 PRESSURE REGULATOR VENT HOLE

Fig. 7-116 Lubrication Chart

BACK TO INDEX

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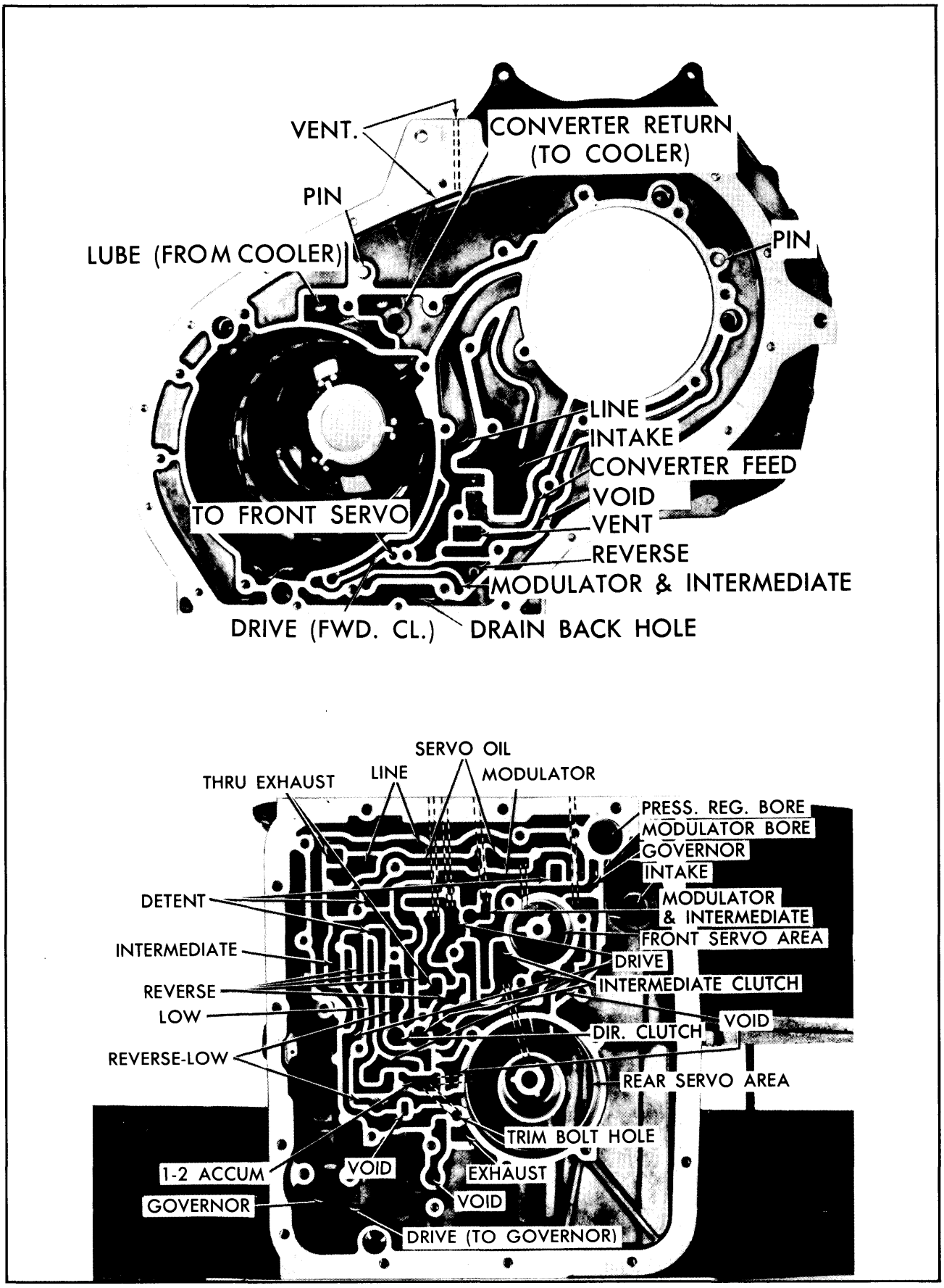


Fig. 7-117 Case Oil Passages—Front and Bottom Views

BACK TO INDEX

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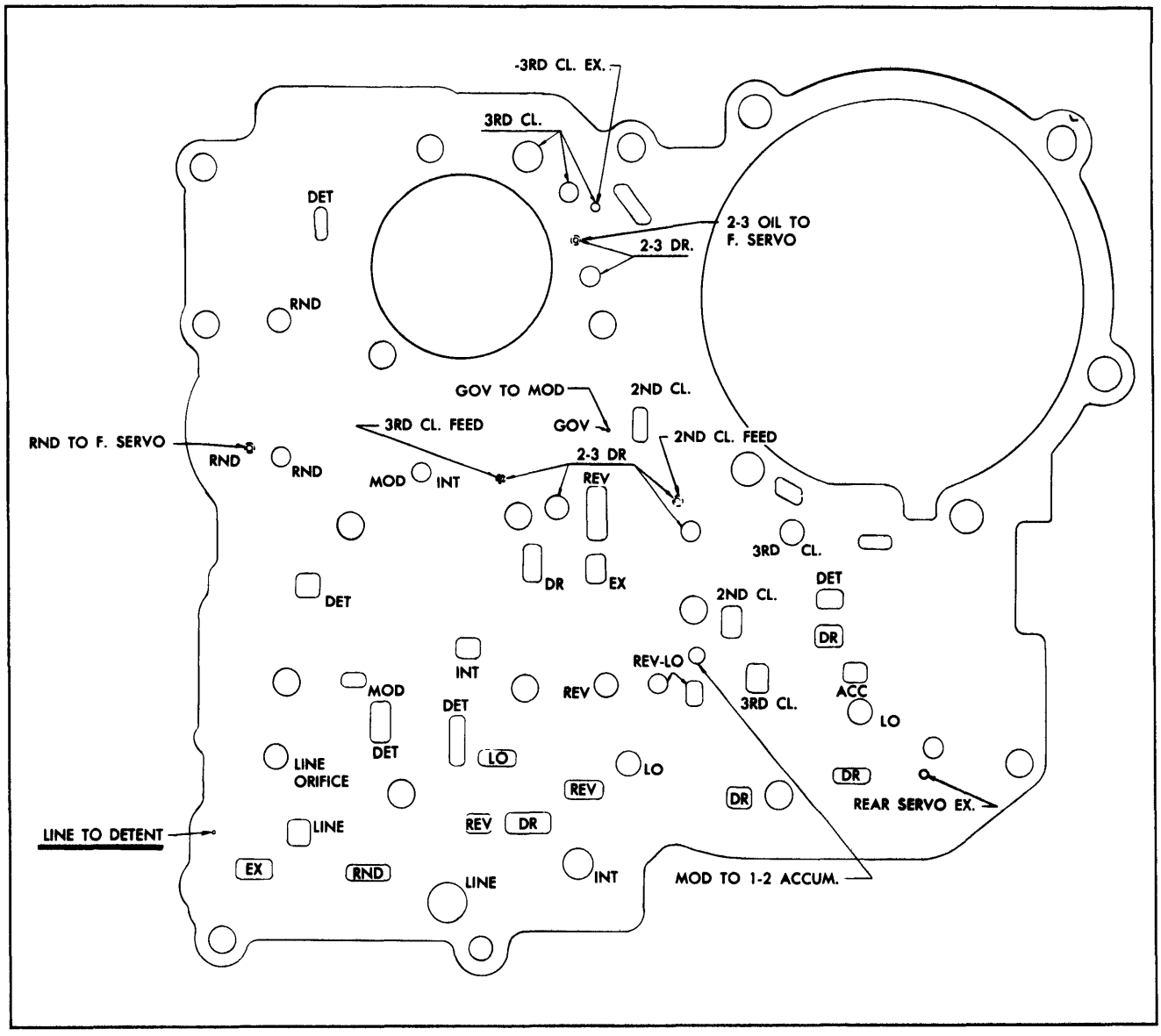


Fig. 7-118 Spacer For Control Valve Assembly

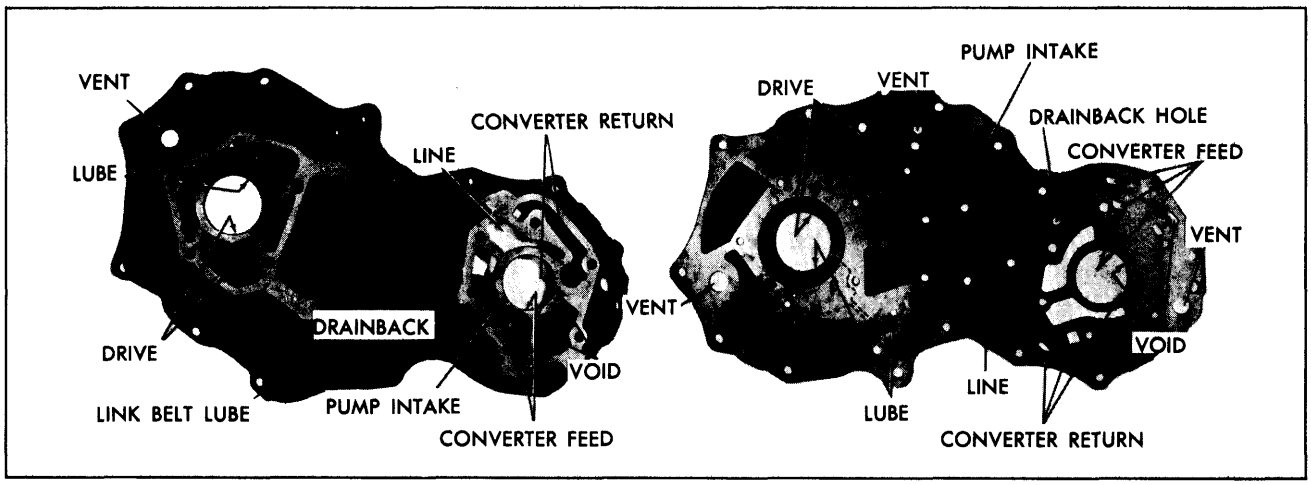


Fig. 7-119 Pump Cover Oil Passages

BACK TO INDEX

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SERVICE INFORMATION

58. Fluid Leakage Precautions

The fluid leakage precautions are listed in Note 1.

59. Points of Possible Oil Leaks

When checking for oil leaks, first determine whether leak originates from transmission or engine. The original factory fill fluid in the transmission is formulated with a red aniline dye to assist in locating leaks. If the color of the dye cannot be detected in the transmission fluid, the fluid should be changed. Red dye appearing in the leaking oil will give positive identification as to the location of the leak.

If oil leak is found to be in transmission, check for leak in following areas:

a. Rear End

It will be necessary to remove converter cover to determine location of leaks at rear end. To correct leaks at rear end, it will be necessary to remove transmission from car.

1. Pump oil seal leak - Check pump oil seal to make certain it is correctly installed and not damaged.

When installing a new pump oil seal, make certain that bore is free from foreign material and that garter spring on seal is correctly positioned. Check finish of converter neck and bearing surface in pump body.

2. Pump assembly-to-case O-ring damaged.
3. Converter - Inspect converter for indications of leakage. See Note 13 for checking procedure.
4. Vent fitting damaged.

b. Cover and Plate Assembly Sprocket Housing Leak

1. Attaching bolts not correctly torqued.
2. Housing to case gasket improperly installed or damaged.
3. Housing to case gasket face not flat.

c. Final Drive to Transmission Leak

1. Attaching bolts not correctly torqued.
2. Final drive to transmission gasket improperly installed or damaged.
3. Mounting surfaces not flat.

d. Transmission Case

1. Speedometer driven gear housing retainer attaching screw loose. Tighten to 18 foot-pounds.
2. Speedometer driven gear housing O-ring or lip seal damaged.
3. Governor cover bale-type attaching retainer not tight.
4. Damaged governor O-ring.
5. Solenoid connector terminal O-ring damaged.
6. Manual shaft O-ring damaged.
7. Vacuum modulator damaged.
8. Vacuum modulator retainer screw loose. Tighten to 18 foot-pounds.
9. Vacuum modulator diaphragm damaged. Check as described in Diagnosis Part V.

(NOTE: A ruptured diaphragm would allow transmission oil to be drawn into intake manifold and vacuum line. Usually the exhaust will be excessively smoky due to transmission oil added to the combustion. Oil level of transmission will also be low.)

10. Bottom pan gasket damaged.
11. Bottom pan attaching screws loose, Tighten to 12 foot-pounds.
12. Line pressure plug not tight. Tighten to 10 foot-pounds.
13. Porous or cracked casting.
14. Vent pipe.
    a. Transmission over-filled.
    b. Water in oil.
    c. Pump to case gasket mispositioned.
    d. Foreign material between pump and case, or between pump cover and body.
    e. Case - Porous, pump face improperly machined.
    f. Pump - Shy of stock, porous.

e. Oil Cooler Pipe Connections

1. Outside oil cooler pipe connections improperly installed or damaged. Also connectors in radiator and transmission.
2. Oil cooler pipe connections not tight. Tighten to 20 foot-pounds.
3. Flare on oil cooler pipes damaged at radiator or transmission.

f. Filler Pipe

1. O-ring damaged or improperly installed on pipe.
2. Filler pipe not fully seated in case.

g. Internal Leaks

It will be necessary to remove bottom pan to determine location of internal leaks.

1. Governor pipes damaged.
2. Control valve assembly-to-spacer or case gaskets damaged.

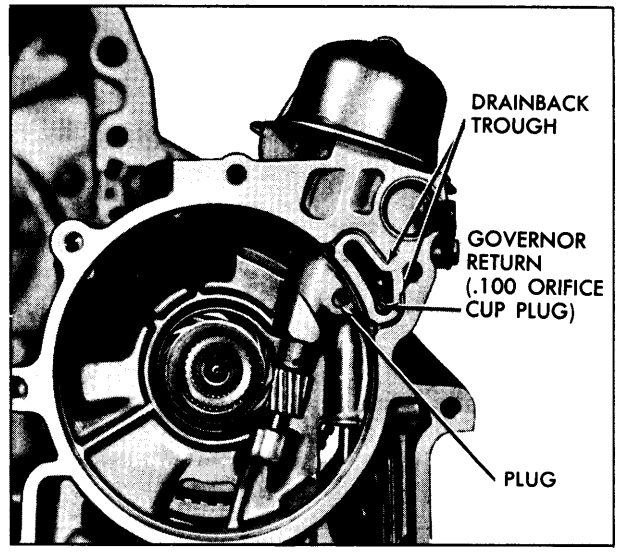
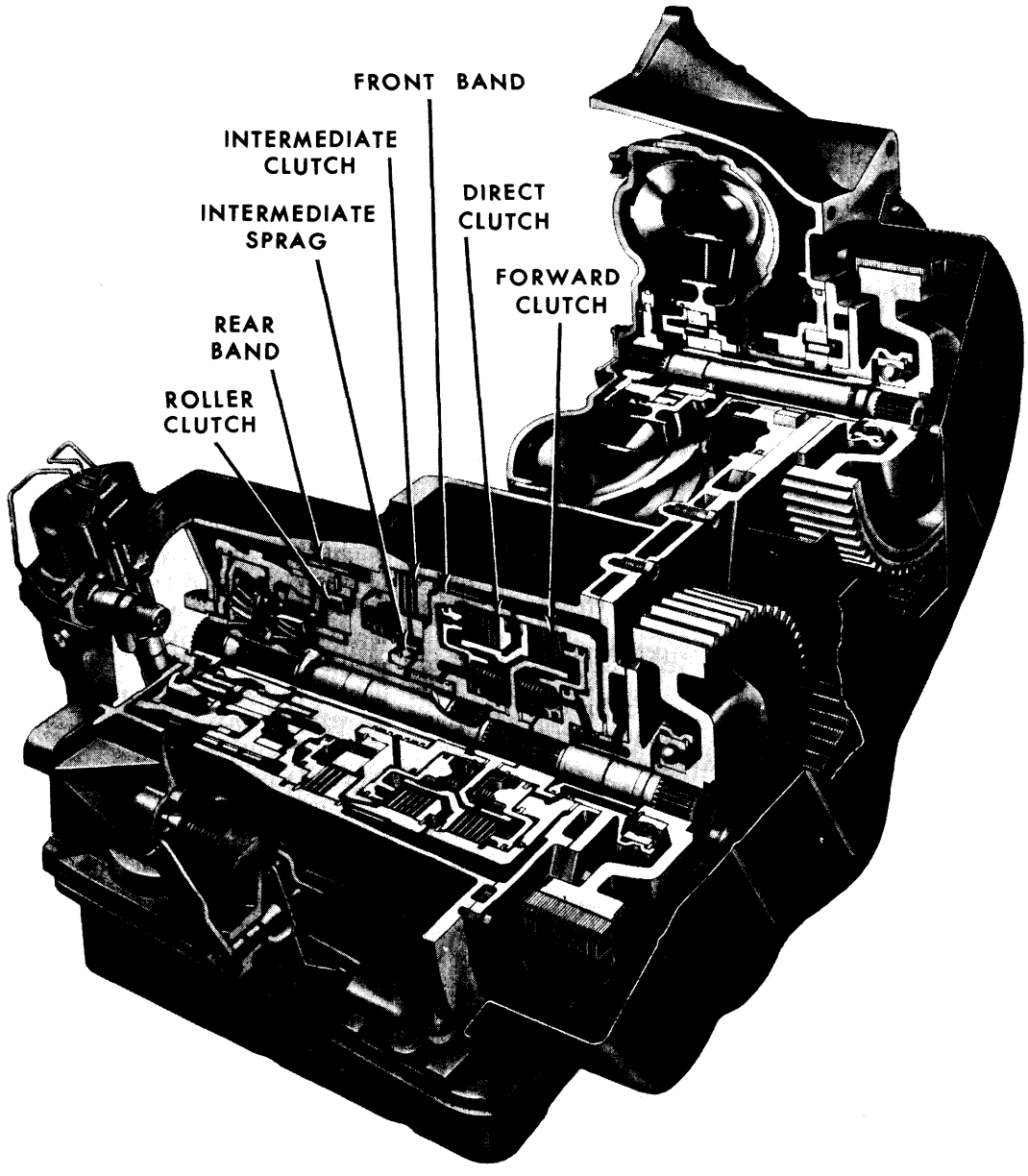


Fig. 7-120 Governor Oil Passages

BACK TO INDEX

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SELECTOR POSITION	PUMP PRESSURE	FORWARD CLUTCH	DIRECT CLUTCH	FRONT BAND	INT. CLUTCH	INT. SPRAG	ROLLER CLUTCH	REAR BAND
PARK—NEUT.	60-150	OFF	OFF	OFF	OFF	OFF	OFF	OFF
DRIVE 1	60-150	ON	OFF	OFF	OFF	OFF	ON	OFF
LEFT 2	60-150	ON	OFF	OFF	ON	ON	OFF	OFF
3	60-150	ON	ON	OFF	ON	OFF	OFF	OFF
DRIVE 1	150	ON	OFF	OFF	OFF	OFF	ON	OFF
RIGHT 2	150	ON	OFF	ON	ON	ON	OFF	OFF
LO 1	150	ON	OFF	OFF	OFF	OFF	ON	ON
2	150	ON	OFF	ON	ON	ON	OFF	OFF
REV.	95 - 230	OFF	ON	OFF	OFF	OFF	OFF	ON

Fig. 7-121 Band, Sprag, Roller Clutch and Clutch Application Chart

BACK TO INDEX

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3. Control valve assembly attaching screws loose. Tighten to 8 foot-pounds.
4. Solenoid gaskets damaged.
5. Solenoid attaching screws loose. Tighten to 10 foot-pounds.
6. Intake pipe O-ring damaged.
7. Rear servo square cut O-ring improperly installed or damaged.

60. Manual Linkage Adjustment (Fig. 7-122)

(NOTE: Cotter pins removed should be discarded and replaced with new cotter pins.)

1. Pull relay rod up to position transmission shift valve in Park, then push rod down to the third (Neutral) step. Make sure rod is centered in this detent position.
2. Loosen adjusting screw on relay lever.
3. Position selector lever in Neutral detent in steering column.
4. Tighten relay rod adjusting screw, making sure shift lever is held against Neutral stop while this operation is being performed.
5. Check operation of selector lever by performing the following steps:

a. Lift lever and move to Neutral detent. (This is the detent in the transmission.) Release the lever and check to make sure that the lever fits into the neutral notch in the steering column.

b. Move lever to Drive detent. There should be a slight travel of the lever beyond this detent until the drive stop in the steering column is reached.

c. Move lever to Reverse detent and check as in b above.

WARNING: WHENEVER LINKAGE IS RE-ADJUSTED, CHECK FOR PROPER OPERATION OF SEAT BELT WARNING SWITCH, PARKING BRAKE RELEASE AND BACK-UP LIGHTS. REFER TO SECTION 12 FOR PROPER METHOD OF CHECKING FUNCTION OF SEAT BELT WARNING SWITCH.

61. Transmission Downshift Switch Adjustment

The procedure for adjusting the transmission downshift switch is described in Note 4.

62. Checking and Adding Fluid

(When checking fluid level the oil temperature and having the car on a level surface are particularly important. Careful attention to the following procedures is necessary in order to determine the actual fluid level.

a. Turbo Hydra-Matic Oil Recommendations

Whenever fluid is added to the transmission use only DEXRON® or DEXRON® II fluid, or fluids of equivalent quality that have been especially formulated and tested for use in the Turbo Hydra-matic transmission.

The transmission dipstick and filler tube on the Eldorado is located under the hood at the left center side of engine.

Under normal driving conditions, the transmission filter and fluid should be changed every 100,000 miles. If the car is driven extensively in heavy city traffic during hot weather, or is used to pull a trailer, change fluid every 50,000 miles. Likewise, operators of cars in commercial use (such as taxi-cab or limousine service) where the engine idles for long periods, should change fluid every 50,000 miles. In any case of a major transmission malfunction, the filter assembly and fluid must be replaced.

b. Checking and Adding Fluid

Automatic transmissions are frequently overfilled because the fluid level is checked when the fluid is cold and the dipstick indicates fluid should be added. However, the low reading is normal since the level will rise as the fluid temperature increases. A level change of over 3/4 inch will occur as fluid temperature rises from 60° to 180° (Celsious 16 to 82.)

Overfilling can cause foaming and loss of fluid through the vent. Slippage and transmission failure can result.

Fluid level too low can cause slipping, particularly, when the transmission is cold or the car is on a hill.

Check the transmission fluid level with the engine running, the shift lever in Park, and the car level.

(NOTE: If the vehicle has recently been operated for an extended period at high speed or in city traffic in hot weather or the vehicle is being used to pull a trailer, an accurate fluid level cannot be determined until the fluid has cooled down – usually about 30 minutes after the vehicle has been parked.)

Remove the dipstick and touch the transmission end of the dipstick cautiously to find out if the fluid is cool, warm or hot.

Wipe it clean and re-insert until cap seats. Remove dipstick and note reading.

If the fluid feels cool, about room temperature (65° to 85°) (Celsious 18 to 29) the level should be 1/8 to 3/8 inch below the ADD mark.

If it feels warm the level should be close to the ADD mark (either above or below).

If it feels hot (cannot be held comfortably) the level should be between the ADD and FULL marks.

(NOTE: DO NOT OVERFILL. It takes only one pint to raise level from ADD to FULL with a hot transmission.)

c. Draining Bottom Pan and Replacing Intake Pipe and Filter Assembly

To drain bottom pan only, eliminate steps 5 and 6.

1. Remove dipstick from filler tube and insert a length of hose secured to a suction gun down the dipstick tube. Remove enough transmission fluid so that

BACK TO INDEX

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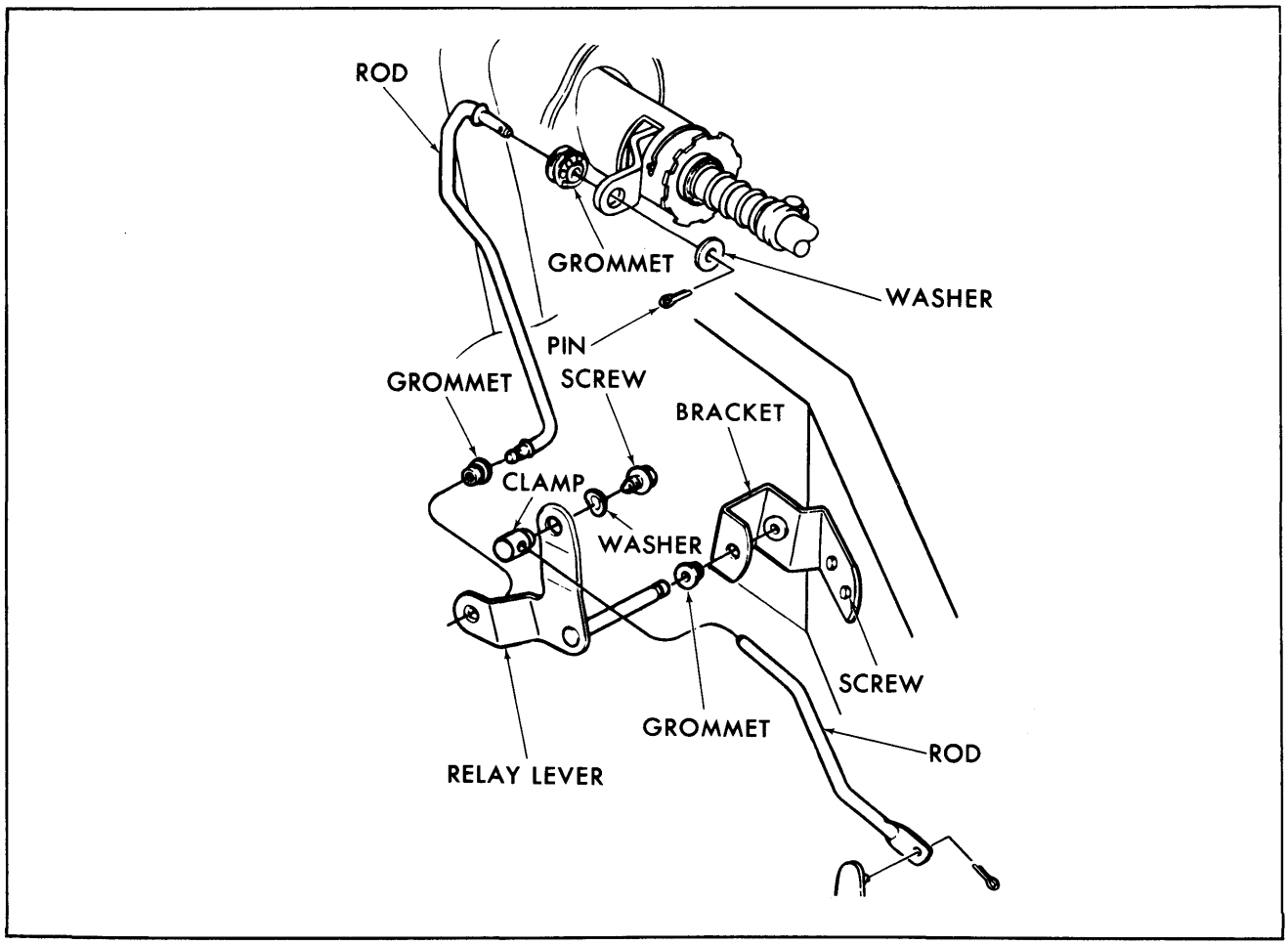


Fig. 7-122 Transmission Linkage

bottom pan will not overflow when removed.

2. Raise car on hoist or place on jack stands, and provide container to collect draining oil.

3. Remove bottom pan and gasket. Discard gasket.

4. Drain fluid from bottom pan. Clean pan with solvent and dry thoroughly with clean compressed air.

5. Remove intake pipe and filter assembly. Remove and discard intake pipe O-ring.

6. Install new intake pipe O-ring into pipe bore in transmission case and install new intake pipe and filter assembly.

7. Install new gasket on bottom pan and install bottom pan. Tighten bottom pan attaching screws to 12 foot-pounds.

8. Lower car and add five quarts of transmission fluid through filler tube when replacing intake pipe and filter assembly. When draining bottom pan only, add four quarts of transmission fluid.

9. Operate engine at 800 rpm for approximately 1-1/2 minutes with selector lever in park "P" position.

10. Reduce engine speed to slow idle and check fluid level. Add fluid to bring to proper level, Fig. 7-123.

d. Adding Fluid to Dry Transmission and Converter Assembly

The fluid capacity of the Turbo Hydra-matic transmission and converter assembly is approximately 13 quarts, but correct level is determined by mark on dipstick rather than by amount added. It is important that proper level be maintained. In cases of transmission overhaul, when a complete fill is required, including converter, proceed as follows:

1. Add 9 quarts of transmission fluid through filler tube.

2. Operate engine at 800 rpm for approximately 1-1/2 minutes with selector lever in park "P" position.

3. Reduce engine speed to slow idle.

4. Check fluid level and add additional fluid to bring to proper level, Fig. 7-123.

e. Sprocket Housing Cover Removal

If the sprocket housing cover is removed, add transmission oil as described in part b of this note.

63. Towing Instructions

Refer to the General Motors Passenger Car and Light Truck Towing Instructions Manual.

64. Units That Can Be Removed With Transmission in Car

The following units can be removed from the transmission without removing transmission from car.

BACK TO INDEX

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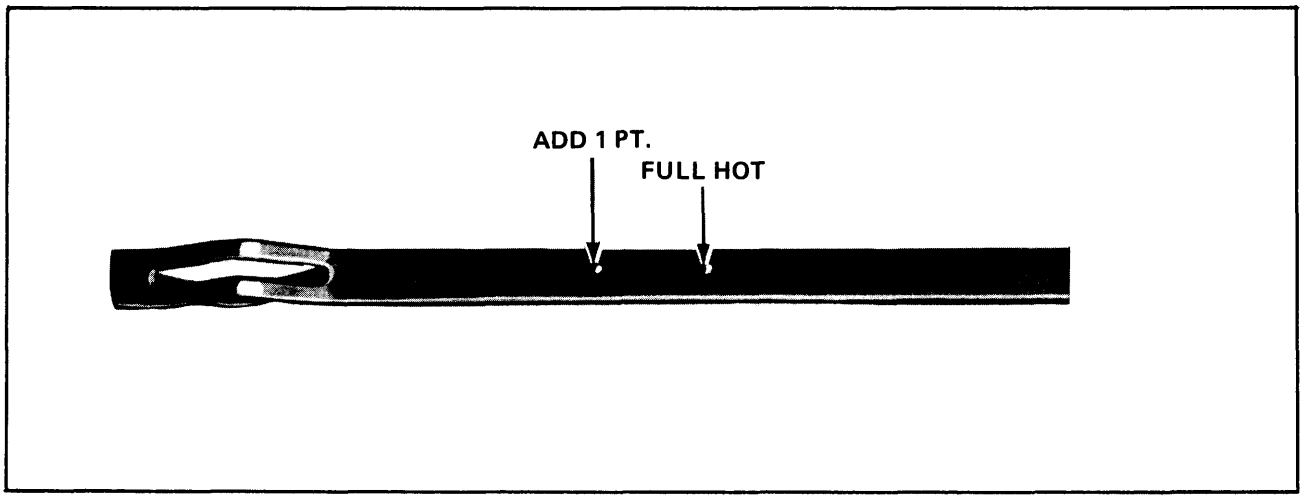


Fig. 7-123 Transmission Oil Level (Eldorado Only)

While the detailed procedure for removing each of the units is not outlined separately, the procedures covered under the transmission disassembly and assembly will apply.

a. Governor Assembly
Removal - Note 68
Disassembly - Note 96
Installation - Note 96

b. Speedometer Driven Gear Assembly
Removal - Note 69
Installation - Note 96

c. Intake Pipe and Filter Assembly and Bottom Pan
Removal - Note 70
Installation - Note 95

d. Control Valve Assembly, Governor Pipes, Detent Spring and Roller Assembly, and Check Balls
Removal - Note 72
Disassembly - Note 94
Installation - Note 94

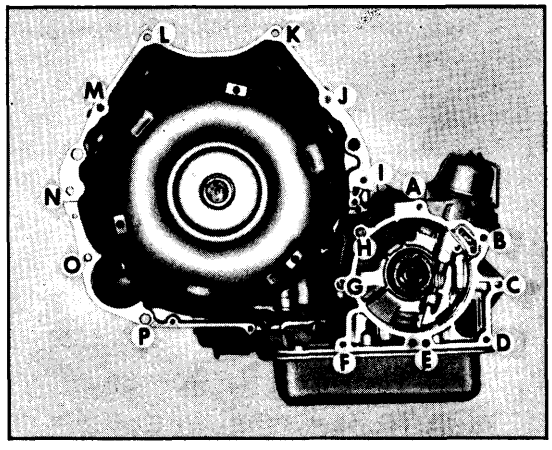


Fig. 7-124 Transmission Attaching Bolts

e. Vacuum Modulator and Valve
Removal - Note 67
Installation - Note 95

f. Pressure Regulator
Removal - Note 71
Installation - Note 95

g. Front Servo and Rear Servo and Accumulator Assembly
Removal - Note 73
Disassembly - Note 93
Installation - Note 93

h. Detent Lever, Manual Shaft, and Parking Linkage
Removal - Note 75
Installation - Note 93

65. Transmission Removal and Installation (Fig. 7-124)

a. Removal

1. Disconnect negative battery cable.
2. Remove transmission dipstick.
3. Loosen nut securing filler tube bracket to exhaust manifold and remove filler tube, catching fluid in clean pan.
4. Remove and discard O-ring on filler tube.
5. Remove bolts at locations "A", "B" and "C", securing final drive case to transmission, Fig. 7-124.
6. Disconnect detent solenoid connector at transmission case.
7. Disconnect speedometer cable from governor assembly.
8. Disconnect oil cooler pipes at transmission using an open end wrench to hold fitting and a tubing wrench

BACK TO INDEX

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or a crowfoot adapter to remove tube nut. Cap pipes and plug connector holes in transmission. Position oil cooler pipes out of way.

9. Remove nut at location "H", securing final drive case to transmission, Fig. 7-124.

10. Remove bolts at locations "I", "J", "K" and "L", securing transmission to engine, Fig. 7-124.

11. Remove ground strap from cowl.

12. Loosen upper left bolt securing converter cover plate to transmission by using a 7/16 inch universal socket and extension. Bolt can be seen from engine compartment.

13. Disconnect starter harness from engine harness.

14. Raise car.

15. Remove bolt at location "O", Fig. 7-124, securing starter motor to transmission case and remove ground strap from bolt.

16. Holding starter, remove bolt at location "P", Fig. 7-124 and remove starter, wiring clip and harness.

17. Disconnect transmission downshift switch connector at transmission.

18. Remove vacuum pipe from vacuum modulator.

19. Remove three remaining bolts securing converter cover plate to transmission and remove cover plate.

20. Position transmission jack, equipped with front wheel drive transmission adapter plate, to transmission at starter motor lower mounting hole, Fig. 7-126.

21. Secure transmission to transmission jack adapter plate with safety chain.

22. Remove three flywheel to converter attaching bolts.

CAUTION: This can be done by installing a 9/16-18 screw, and washer into end of crankshaft at harmonic balancer, after removing cork plug, and rotating converter and flywheel until screws are accessible for removal. Do not pry on flywheel ring gear to rotate flywheel and converter, as flywheel may be damaged.

23. Remove cotter pin securing relay rod to manual yoke on left side of transmission and separate relay rod from yoke.

24. Remove bolts at location "M" and "N", Fig. 7-155, securing transmission to engine.

25. Remove bolts at location "D", "E", "F" and nut location "G", securing final drive to transmission, Fig. 7-124.

(NOTE: Position drain pan under point where transmission and final drive meet as transmission fluid will be lost when transmission and final drive are separated.)

26. Loosen final drive through bolt at upper mount.

27. Through access holes in bottom of transmission support bar, remove two bolts securing rear motor mount to transmission support bar.

28. Remove motor mount from bracket and remove both from chassis.

29. Use small pry bar to separate transmission from engine and final drive.

CAUTION: Select pry points with care to avoid damaging any components.

30. After initial separation has been made, allow transmission oil to drain at final drive junction.

31. Pry and hold final drive forward, move transmission rearward to disengage transmission case from dowels on engine and to disengage final drive from studs on transmission case.

CAUTION: Final drive unit is limited in its forward travel.

32. Slowly lower transmission, making certain top of transmission case clears flywheel ring gear.

33. Pry final drive forward and input end downward pivoting around through bolt to provide clearance for final drive input shaft.

34. When converter is approximately half-way exposed from flywheel, install Converter Holding Clamp, J-21366, using a 5/16-18 nut to hold clamp screw to transmission case at location "N", Fig. 7-124.

CAUTION: Converter Holding Clamp, J-21366, must be used to avoid the possibility of the converter becoming disengaged when the transmission is removed.

35. Remove and discard final drive gasket and clean mounting surface of final drive.

b. Installation

1. Position transmission on jack equipped with adapter plate, under car.

2. Install new gasket on final drive, after first soaking gasket with transmission fluid.

3. Remove Converter Holding Clamp, J-21366, from transmission.

4. Raise transmission in place while prying final drive forward and input shaft downward.

5. Holding final drive with pry bar, continue raising transmission, making certain top of transmission case clears splined input shaft of final drive, and position to engine.

6. Position transmission to engine assembly and final drive by aligning the following points in order listed:

a. Studs on transmission case to mounting holes in final drive.

b. Guide holes in transmission case to dowels on engine crankcase.

c. Internal flange on final drive to transmission.

CAUTION: As engagement of splined final drive input shaft to transmission is hidden, extreme care must be taken to avoid damaging transmission or final drive assembly.

d. To facilitate engagement of final drive splines, rotate one front wheel while helper holds other.

(NOTE: When alignment is complete and proper, gap between final drive case and transmission should not exceed 1/4 inch.)

7. Loosely install bolts at locations "D" and "F" attaching transmission to final drive and bolt at location "N" attaching transmission to engine, Fig. 7-124. Alternately tighten bolts to avoid cocking transmission. Do not torque bolts at this time.

BACK TO INDEX

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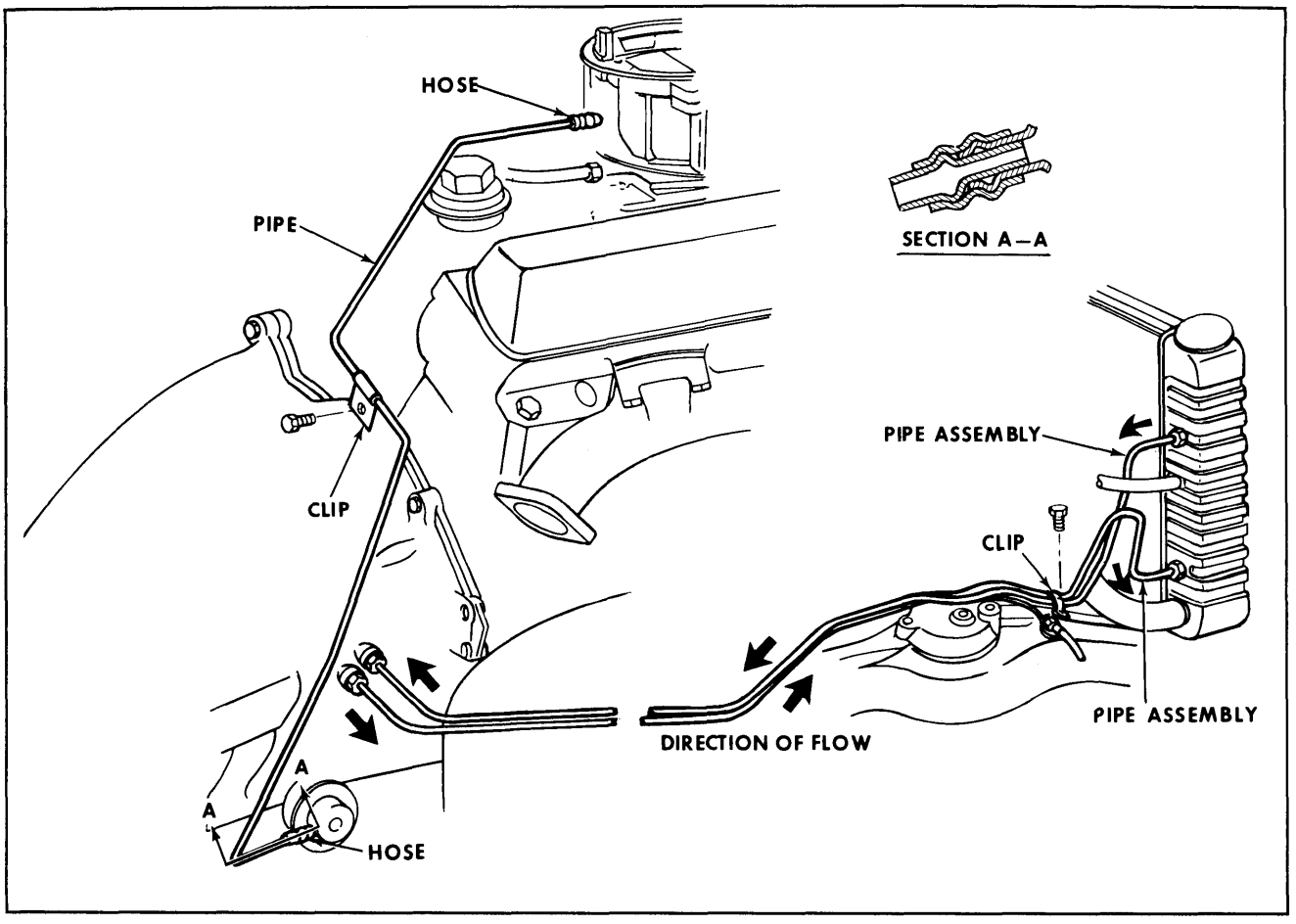


Fig. 7-125 Transmission External Components

8. Position rear engine mount and bracket on top of transmission support bar against underbody. Secure mount to bracket with three screws. Loosely install two screws holding transmission mount to support bar.

9. Perform following work in engine compartment:

a. Loosely install bolts at locations "M" and "J" attaching transmission to engine crankcase, Fig. 7-124. Do not torque bolts at this time.

b. Position rear engine mount bracket to engine and install bolts at locations "K" and "L", Fig. 7-124.

10. Remove safety chain, remove bolt securing jack adapter plate to transmission case and remove transmission jack.

11. Torque the following bolts as specified.

a. Rear engine mount to transmission support bar - 55 foot-pounds.

b. Rear engine mount to bracket - 25 foot-pounds.

c. Transmission to engine (location "M" and "N", Fig. 7-124) - 30 foot-pounds.

CAUTION: The procedure for attaching the converter to the flywheel as described in steps 12 through 14 must be strictly followed. Any deviation from this procedure will result in improper installation and damage to flywheel and transmission.

12. Rotate converter until two of the three weld nuts on converter line up with two of the three holes in flywheel. Position converter so that weld nuts are flush with flywheel, making certain converter is not cocked and that pilot in center of converter is properly seated in crankshaft.

13. Install two flywheel to converter attaching bolts through accessible holes in flywheel and tighten finger tight.

14. Rotate flywheel and converter by rotating screw previously installed in forward end of crankshaft, until

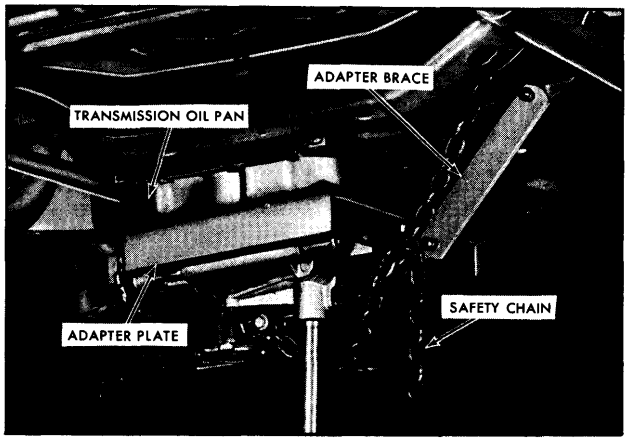


Fig. 7-126 Positioning Transmission Jack

BACK TO INDEX

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third hole is accessible. Install third bolt and tighten all bolts to 30 foot-pounds. Remove screw from crankshaft and install cork plug.

15. Install vacuum hose on vacuum modulator assembly and connect transmission downshift switch wire at connector.

16. Position converter cover plate to transmission case and install two lower and one upper right bolts securing cover plate to transmission, tightening to 5 foot-pounds.

17. Position starter to transmission case and install bolt and starter motor wiring clip at location "P", Fig. 7-124.

18. Position ground strap to transmission and install bolt securing ground strap and starter motor to transmission at location "O". Tighten bolts at locations "O" and "P" to 25 foot-pounds, Fig. 7-124.

19. Install bolts at locations "C" and "E" and nut at location "G", securing transmission to final drive, Fig. 7-124.

20. Torque bolts at locations "C" through "F" to 35 foot-pounds, Fig. 7-124.

21. Position relay rod to manual lever and secure with cotter pin.

22. Check operation of manual linkage and adjust, if necessary, as described in Note 60.

23. Lower car.

24. Connect starter harness to engine harness.

25. Install bolts at location "A" and "B" and nut at location "H", securing transmission to final drive, Fig. 7-124. Tighten bolts to 35 foot-pounds.

26. Install upper left bolt securing converter cover plate to transmission using 7/16 inch universal socket and extension.

27. Torque bolts at locations "I", "J", "K" and "L" to 25 foot-pounds, Fig. 7-124. Vacuum modulator pipe bracket is also installed at location "L".

28. Tighten cooler pipe connectors at case to 20 foot-pounds. Clean ends of cooler pipes with solvent, reposition cooler pipes and connect pipes to transmission using an open end wrench to hold fitting and a tubing wrench or crowfoot adapter, Fig. 7-125. Tighten to 20 foot-pounds.

29. Install speedometer cable and detent solenoid connector.

30. Install new O-ring on transmission filler tube and install filler tube through hole in final drive case.

31. Position transmission filler tube bracket to exhaust manifold and install retaining nut.

32. Install body ground strap to cowl.

33. Connect negative battery cable.

34. Fill transmission with fluid as required, see Note 62.

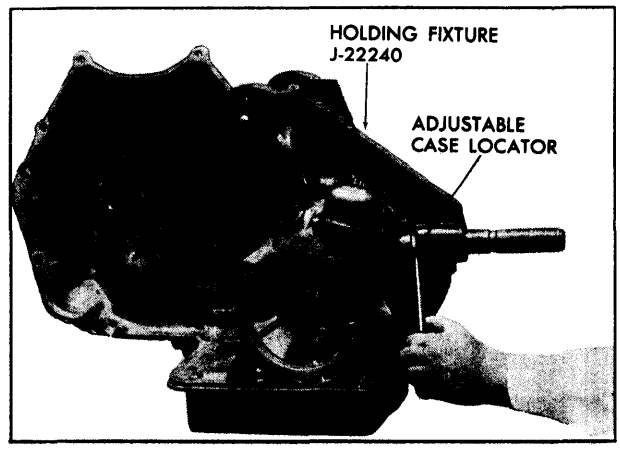


Fig. 7-127 Attaching Transmission Holding Fixture

66. Installing Transmission on Holding Fixture

1. With transmission on portable jack, remove Converter Holding Clamp, J-21366, and then remove converter assembly from transmission by pulling converter straight out of housing.

CAUTION: Converter with oil weighs approximately 50 pounds. Be careful not to drop or damage converter when removing it.

If transmission is to be overhauled, place converter on opposite end of workbench from transmission Holding Fixture Base.

2. Position Transmission Holding Fixture, J-22240, to transmission, Fig. 7-127.

3. Attach Holding Fixture, J-22240, to transmission using a 3/8-16 x 2-1/4 inch bolt and nut at location "J". Use special screw provided with Holding Fixture to attach Holding Fixture to rear side of transmission case.

4. Tighten adjustable case locator pivot bolt to boss on side of transmission case.

CAUTION: Do not over torque adjustable case locator nut.

5. Install Transmission Holding Fixture, J-22240, and transmission into Holding Fixture Base, J-3289-01, then install lock pin in base.

6. Remove transmission jack from transmission.

7. Provide a container to catch any oil that may drain from transmission.

MAJOR TRANSMISSION COMPONENTS—REMOVAL

67. Remove Vacuum Modulator and Valve

(NOTE: Unit may be removed without removing transmission or bottom pan, after removing vacuum hose.)

1. Remove vacuum modulator attaching screw and retainer from transmission case.

2. Remove modulator assembly and O-ring from transmission case. Remove and discard O-ring from vacuum modulator, Fig. 7-128.

BACK TO INDEX

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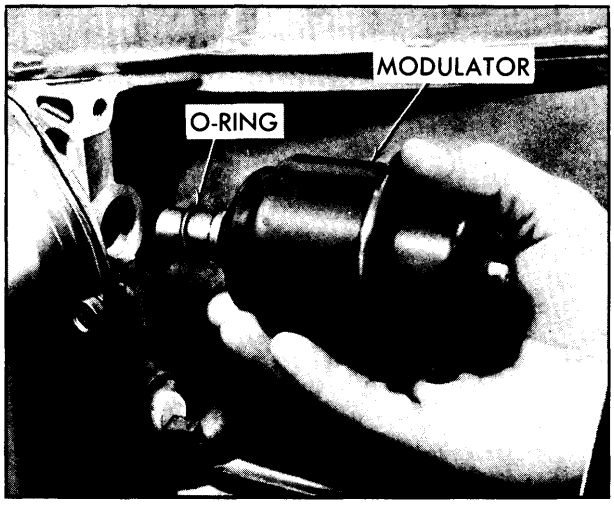


Fig. 7-128 Removing Vacuum Modulator

3. Remove modulator valve from transmission case, Fig. 7-129.

(NOTE: Modulator bushing is a tight fit in transmission case and should not be removed forcibly unless it is damaged, scored, or otherwise deformed.)

68. Remove Governor Assembly

(NOTE: Unit may be removed without removing transmission from car.)

1. Force top of spring clip downward, releasing governor assembly.
2. Remove governor assembly from case, and remove square-cut O-ring from governor assembly and discard O-ring, Fig. 7-130.

(NOTE: The governor assembly, including the driven gear, is replaceable. See Note 96.)

69. Remove Speedometer Driven Gear

(NOTE: Unit may be removed without removing transmission from car or without removing governor assembly.)

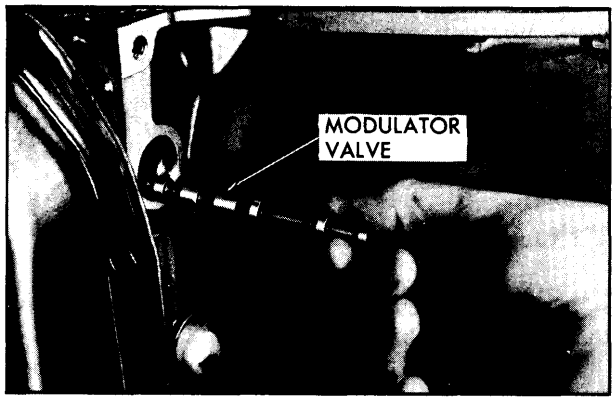


Fig. 7-129 Removing Modulator Valve

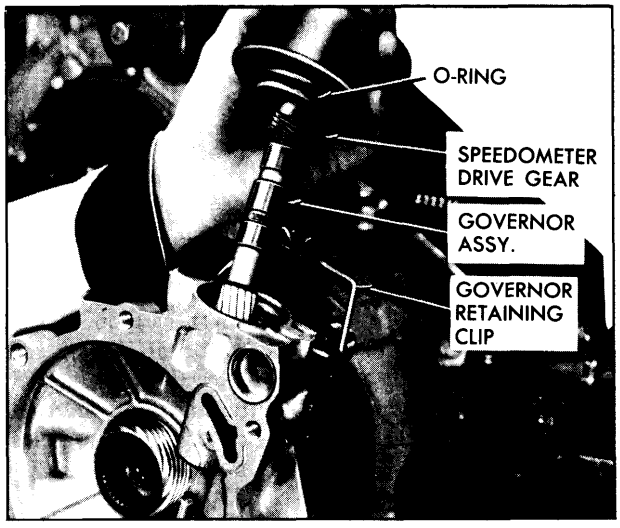


Fig. 7-130 Removing Governor Assembly

1. Remove attaching screw and retainer from left side of case. Apply slight pressure to remove sleeve and speedometer driven gear.
2. Remove and discard O-ring from speedometer driven gear assembly.

70. Remove Intake Pipe and Filter Assembly and Bottom Pan

(NOTE: Units may be removed with transmission in car. In cases of transmission malfunction, intake pipe and filter must be replaced.)

1. Rotate transmission and Holding Fixture in Holding Fixture Base so that transmission bottom pan is up. Position container to catch any fluid which may drain from transmission.
2. Remove 13 bottom pan attaching screws.
3. Remove bottom pan and gasket, discarding gasket.
4. Lift out intake pipe and filter assembly, Fig. 7-131.

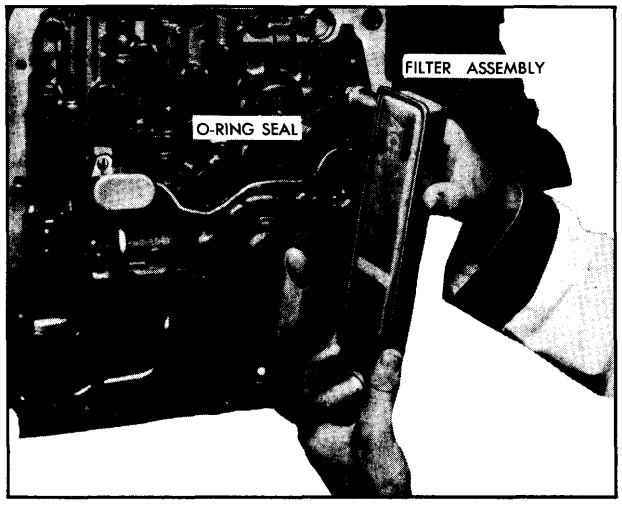


Fig. 7-131 Removing Filter Assembly

BACK TO INDEX

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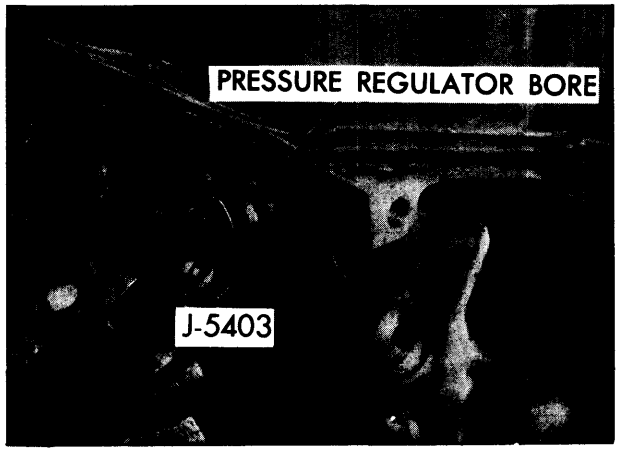


Fig. 7-132 Removing Pressure Regulator Valve

5. Remove and discard intake pipe O-ring, Fig. 7-131.

71. Remove Pressure Regulator Valve

(NOTE: Unit may be removed with transmission in car after removing bottom pan.)

1. Compress regulator boost valve bushing against pressure regulator spring and remove snap ring using Snap Ring Pliers, J-5403 (#21), Fig. 7-132.

WARNING: PRESSURE REGULATOR SPRING IS TIGHTLY COMPRESSED.

2. Remove regulator boost valve bushing and valve.
3. Remove pressure regulator spring.
4. Remove regulator valve, spring retainer, and spacer or spacers if present.

72. Remove Control Valve Assembly, Governor Pipes, Detent Spring, and Roller Assembly, and Check Balls

(NOTE: Units may be removed with transmission in car, after removing bottom pan.)

1. Remove attaching screw and remove detent roller and spring assembly.
2. Disconnect detent wire from case connector.
3. Remove governor feed pipe from transmission case and valve body by lifting straight out, Fig. 7-133.
4. Remov nineteen remaining control valve assembly attaching screws. Do not remove detent solenoid attaching screws at this time.

(NOTE: If the transmission is in the vehicle, the front servo piston assembly may drop down as the control valve assembly and governor pipe are removed.)

5. Remove control valve assembly with remaining governor pipe attached, Fig. 7-134.

CAUTION: Do not allow manual valve to fall out of its bore in control valve assembly.

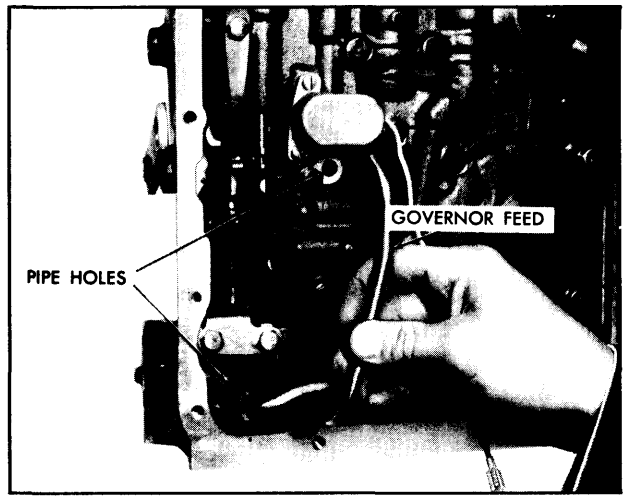


Fig. 7-133 Removing Governor Feed Pipes

6. Remove remaining governor pipe from valve body.
7. Remove control valve assembly to spacer gasket.
8. Remove control valve spacer and spacer-to-transmission case gasket, Fig. 7-135.

CAUTION: If control valve assembly is removed in car, seven check balls will come down with spacer.

9. Remove seven check balls from cored passages in transmission case.

(NOTE: The eighth check ball is held in by a retainer and should not be removed unless replacement is required.)

73. Remove Front Servo Piston and Rear Servo Piston

(NOTE: Units may be removed with transmission in car after removing bottom pan and control valve assembly.)

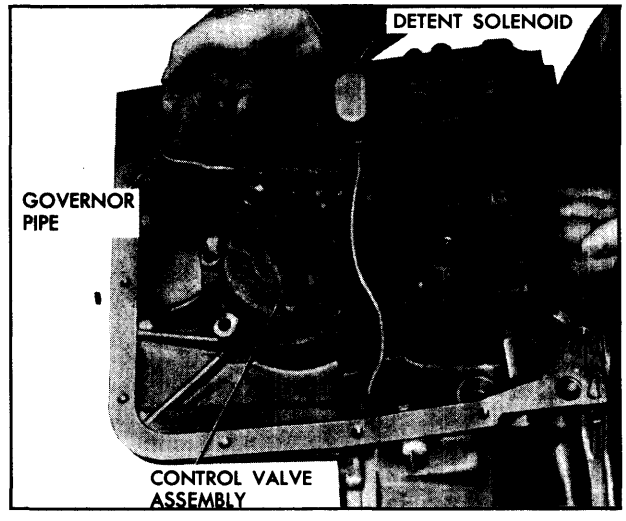


Fig. 7-134 Removing Control Valve Assembly

BACK TO INDEX

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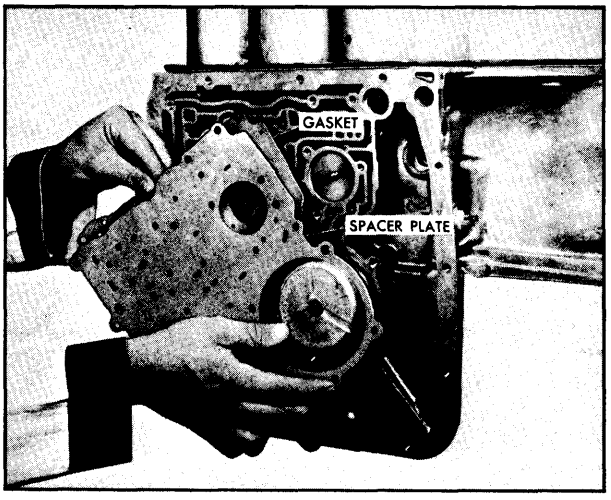


Fig. 7-135 Removing Control Valve Spacer

1. Lift front servo piston retainer ring, pin, spring retainer and spring out of transmission case.
2. Remove rear servo assembly from transmission case.
3. Remove rear servo accumulator spring.
4. Make band apply pin selection check to determine proper size pin to use at time rear servo is assembled. Proceed as described in Note 74.

74. Band Apply Pin Selection Check (Fig. 7-136)

(NOTE: Check may be made with transmission in car. Remove bottom pan, control valve assembly, and rear servo.)

1. Position Adapter Plate, J-21370-8, on transmission case over rear servo bore, and, using screws provided with Adapter Plate, attach Band Apply Pin Selector Gage, J-21370-4 to Adapter Plate.

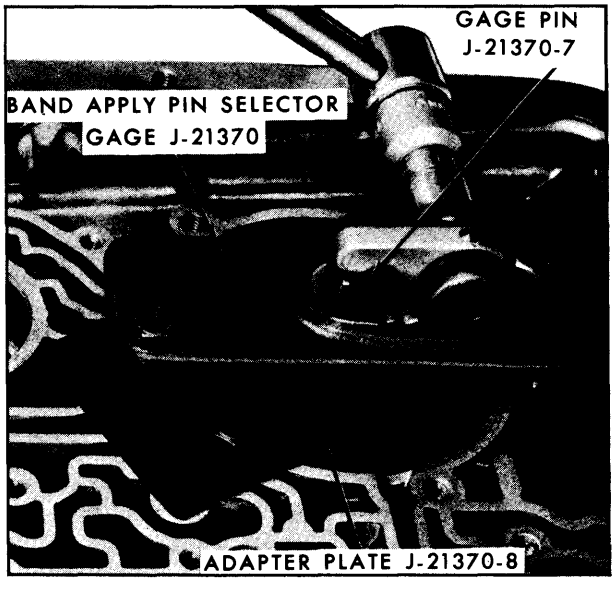


Fig. 7-136 Band Apply Pin Selection Check

2. Position Band Apply Pin Selector Gage, J-21370-4, with hex nut on side of page facing toward converter housing, and smaller diameter end of Gage Pin, J-21370-7, in servo pin bore.
3. Secure Adapter Plate to transmission case with two 5/16-18 x 1 inch screws, tightening screws to 18 foot-pounds and secure Selector Gage to Adapter Plate, tighten attaching screws to 18 foot-pounds. Make certain that stepped gage pin is free to move up and down in both tool and servo pin bore. Stepped side of pin must face rear of transmission case.

Band apply pins are available in three sizes as shown in the following chart:

Identification	Length
Three Rings	Long
Two Rings	Medium
One Ring	Short

Identification ring is located on band lug end of pin. Selecting the proper pin is equivalent to adjusting band.

4. To determine proper size pin to use, apply 25 foot-pounds torque on hex nut on side of gage. This will cause lever on top of gage to depress stepped gage pin into servo pin bore, simulating actual operating conditions. Note relation of steps on gage pin and machined surface on top of gage. Determine proper size pin as follows:

a. If machined surface on top of gage is even with or above upper step on gage pin, long size pin (three rings) is required.

b. If machined surface on top of gage is even with or below lower step on gage pin, short size pin (one ring) is required.

5. If new pin is required, make note of pin size required, and remove gage from transmission case.

75. Remove Detent Lever, Manual Shaft, and Parking Linkage (Fig. 7-137)

(NOTE: Units may be removed with transmission in car after removing bottom pan and detent roller and spring assembly from control valve assembly.)

1. Remove pin securing manual shaft to case by pulling straight out.
2. Loosen locknut securing detent lever to manual shaft.
3. Pry or work detent lever loose from ground flats on manual shaft.
4. Remove manual shaft from case bore and remove and discard O-ring seal from manual shaft.

(NOTE: Be careful not to drop jam nut inside of case.)

5. Remove detent lever and parking brake actuator assembly from case and remove actuator assembly from detent lever.
6. Remove parking brake bracket attaching screws and remove bracket.

BACK TO INDEX

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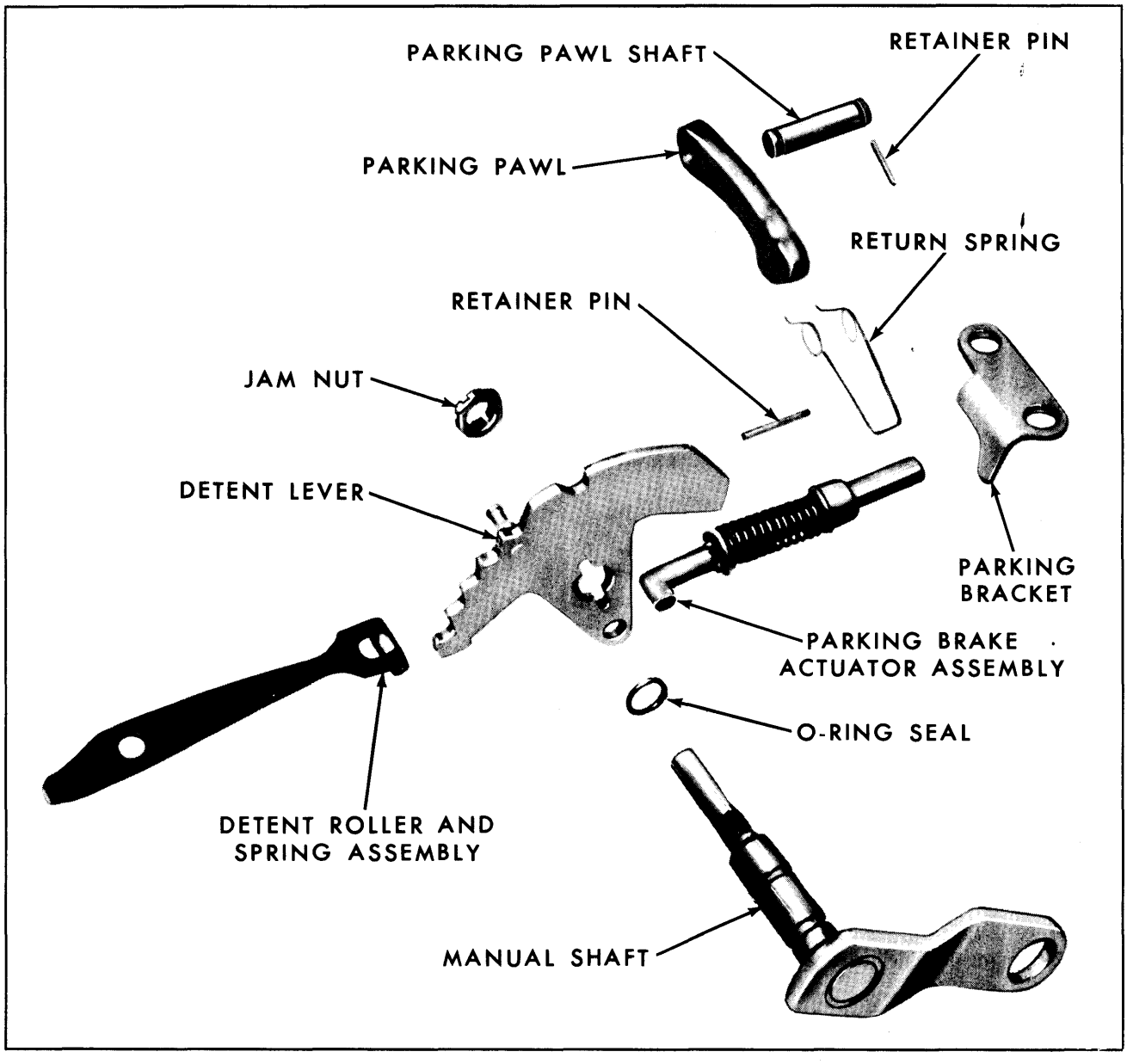


Fig. 7-137 Manual and Parking Linkage—Disassembled View

7. Remove retainer pin securing parking pawl shaft to transmission case by pulling straight out.

8. Remove parking pawl shaft, parking pawl and return spring.

76. Remove Sprocket Cover, Link Assembly, Drive and Driven Sprockets

1. Rotate transmission in holding fixture base so that sprocket cover is up and remove eighteen cover attaching screws.

2. Remove cover and gasket and discard gasket.

3. Install Snap Ring Pliers, J-4646, into sprocket bearing retaining snap rings located under the drive and driven sprockets, and remove snap rings from retaining grooves on support housing, Fig. 7-138.

(NOTE: Leave snap rings in a loose position between sprockets and bearing assemblies.)

4. Remove drive and driven sprockets, link assembly, bearings, and shafts simultaneously by alternately pulling upwards on the drive and driven sprockets until the bearings are out of the drive and driven support housings, Fig. 7-139.

(NOTE: If the sprockets are difficult to remove, place a small piece of fiberboard between the sprocket and sprocket support cover. Using a 1/2 x 9 inch pry bar, alternately pry upward under each sprocket on sprocket support cover. Do not pry on the guide links or the aluminum case. Pry only on the sprockets, Fig. 7-140.)

5. Remove link assembly from drive and driven spockets.

6. Remove the teflon oil seal ring from turbine

BACK TO INDEX

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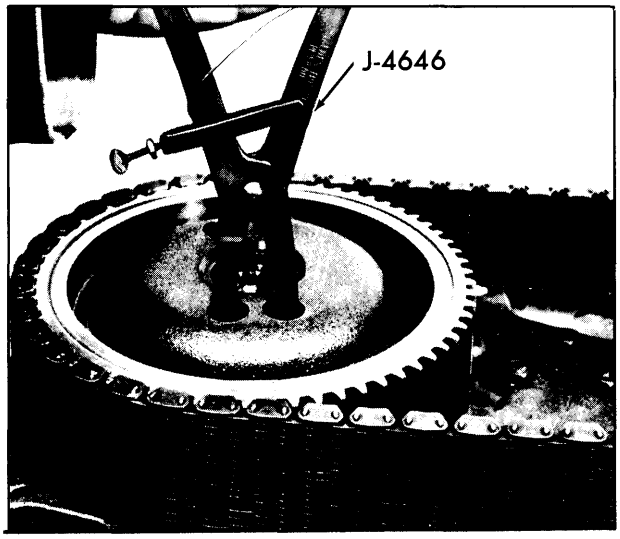


Fig. 7-138 Removing Sprocket Snap Ring

shaft only if the ring requires replacement. For service the ring is hook type cast iron.

7. Inspect drive and driven sprocket bearing assemblies for rough or malfunctioning bearings.

(NOTE: Do not remove bearing assemblies from drive and driven sprockets unless they need replacement.)

8. If removal of bearing assembly from drive and/or driven sprockets is necessary, proceed as follows:

a. Remove sprocket to bearing assembly retaining snap ring using Snap Ring Pliers, J-8059, Fig. 7-141.

b. Mount sprocket, with turbine or input shaft placed down between two 2" x 4" x 10" wood blocks.

(NOTE: Wood blocks are positioned on sides or ends, depending on which bearing is to be replaced.)

c. With a hammer and brass rod, drive the inner race, alternately through each of the access openings, until the bearing assembly is removed from the sprocket hub, Fig. 7-142.

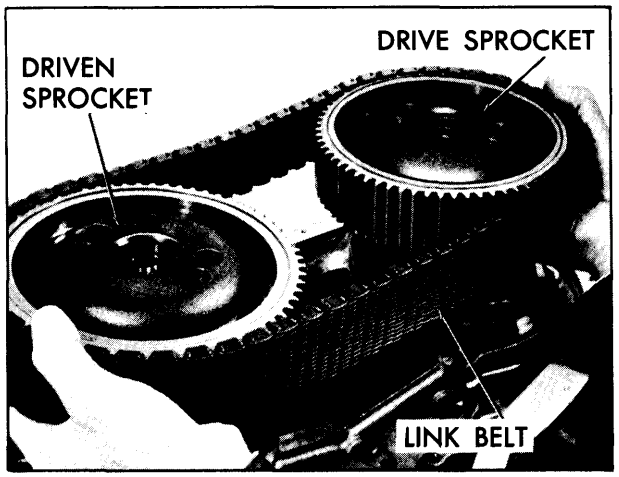


Fig. 7-139 Removing Sprocket and Link Assembly

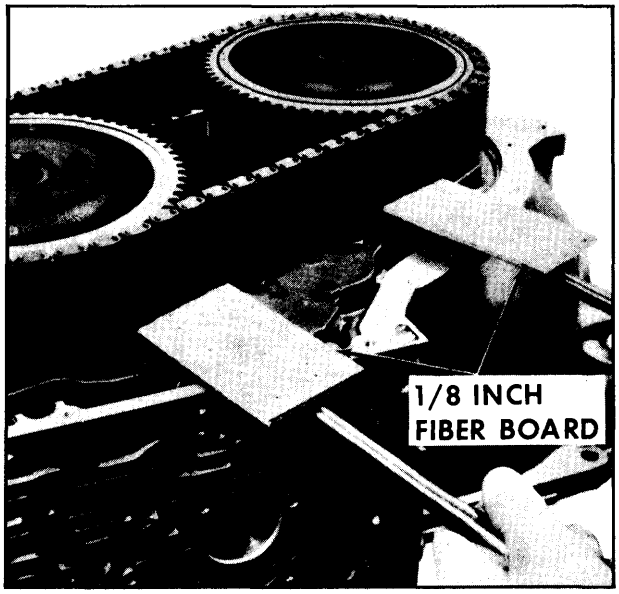


Fig. 7-140 Removing Tight Sprockets

77. Inspect Drive Sprocket and Turbine Shaft, and Link Assembly

1. Inspect drive sprocket teeth for nicks, burrs, scoring, galling, and excessive wear.

(NOTE: Wear pattern at bottom of tooth form is normal.)

2. Inspect drive sprocket to ball bearing retaining snap ring for damage.

3. Inspect drive sprocket ball bearing inner race mounting surface for damage.

4. Inspect turbine shaft for open lubrication passages. Run a tag wire through the passages to be sure they are open. See lubrication chart for passage location, Fig. 7-116.

5. Inspect spline for damage.

6. Inspect the ground bushing journals for damage.

7. Inspect the oil seal groove for damage or excessive wear.

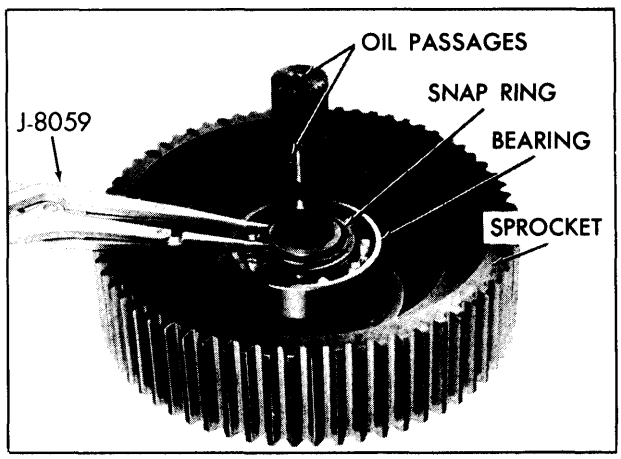


Fig. 7-141 Removing Sprocket Bearing Snap Ring

BACK TO INDEX

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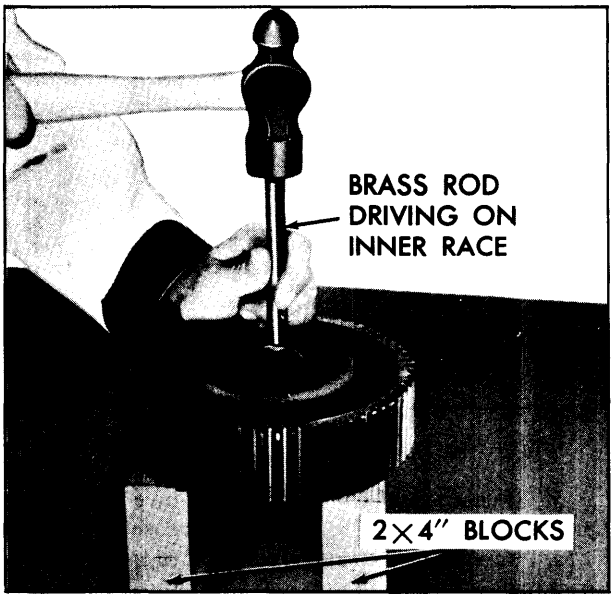


Fig. 7-142 Removing Sprocket Bearing

8. Inspect turbine shaft oil seal ring for damage. Do not remove unless replacement of ring is required for service. The ring is hook type cast iron.

9. Inspect the turbine shaft for cracks or distortion.

10. Inspect the link assembly for damage or loose links.

(NOTE: Check the guide links. Guide links are the wide outside links on each side of the link assembly.)

78. Inspect Driven Sprocket and Input Shaft

1. Inspect driven sprocket teeth for nicks, burrs, scoring, galling, and excessive wear.

(NOTE: Wear pattern at bottom of tooth form is normal.)

2. Inspect sprocket to ball bearing retaining snap ring for damage.

3. Inspect ball bearing inner race mounting surface for damage.

4. Inspect input shaft for open lubrication holes. Run a tag wire through the holes to be sure they are open. See Fig. 7-116 for location of holes.

5. Inspect spline for damage.

6. Inspect ground bushing journal for damage.

79. Install Sprocket Bearings

1. Turn sprocket so that turbine or input shaft is pointing upward.

2. Install new sprocket bearing as follows:

a. Install support snap ring, letter side down onto shaft.

b. Assemble bearing assembly on turbine or input shaft.

c. Using a piece of pipe, drive the bearing assembly onto the hub of the sprocket until it is resting on the bearing seat of the sprocket.

CAUTION: Use pipe that closely fits I.D. of bearing assembly but does not contact shaft.

d. Install sprocket to bearing assembly retaining snap ring into groove in sprocket hub.

3. If necessary install hook type oil seal ring on turbine shaft.

(NOTE: Turbine and/or input shaft may appear not to be pressed fully into the sprocket. Do not attempt pressing shaft further as a specific length dimension is held during initial assembly.)

80. Front Unit End Play Check

1. Install Front Unit End Play Checking Tool, J-22241, into driven sprocket housing so that the urethane on the tool can engage the splines in the forward clutch housing. Let the tool bottom on the mainshaft and then withdraw it approximately 1/8 inch and tighten nut on tool, Fig. 7-143.

2. Remove one bolt from the driven support housing, and install Slide Hammer Bolt, J-6125-1, into bolt hole in driven support housing.

(NOTE: Do not thread slide hammer bolt deep enough to interfere with forward clutch housing travel.)

3. Mount Dial Indicator, J-8001-02, on slide hammer bolt and index indicator to register with the Front Unit End Play Checking Tool, J-22241, Fig. 7-143 and push tool down to remove slack.

4. Push and hold output flange upward. Place a screw driver in case opening at parking pawl area and push upward on output carrier.

5. Place a screw driver between the metal lip of the end play tool and the driven sprocket housing and push upward on the metal lip of the end play tool and read

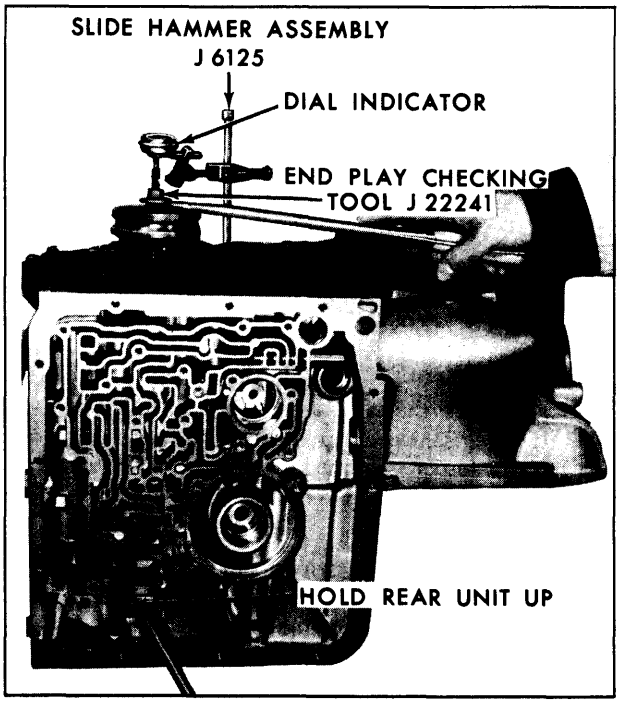


Fig. 7-143 Checking Front Unit End Play

BACK TO INDEX

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the resulting end play, which should be between .003" and .024".

The selective washer controlling this end play is the thrust washer located between the driven support housing and the forward clutch housing. If more or less washer thickness is required to bring the end play within specifications, select the proper washer from the chart below:

THICKNESS	COLOR
.060-.064	Yellow
.071-.075	Blue
.082-.086	Red
.093-.097	Brown
.104-.108	Green
.115-.119	Black
.126-.130	Purple

(NOTE: An oil soaked washer may tend to discolor so that it will be necessary to measure the washer with a set of one inch micrometers to determine actual thickness.)

6. Remove end play tool from transmission and remove dial indicator and slide hammer bolt from transmission.

81. Remove Oil Pump

1. Remove two opposite pump attaching bolts from the drive support housing.
2. Install two 5/16-18 x 4" guide pins in holes from previously removed bolts.
3. Remove the remaining pump attaching bolts from the drive support housing.
4. With one hand hold the underside of the pump and gently tap the guide pins until the pump is removed from the case.

82. Remove Pump Cover Plate, Converter Out Check Valve and Drive and Driven Support Housing Assemblies

1. Remove the twenty-three pump cover plate-to-case attaching screws and remove pump cover plate. Do not remove sprocket support housing bolts at this time.
2. Remove pump cover plate and plate-to-case face gasket. Discard gasket.

(NOTE: Drive and driven support housing assemblies are pressed into and removed with the pump cover plate. Do not remove them unless it is necessary.)

3. Remove oil seal rings from the driven support housing if damaged.
4. Remove the front unit end play selective thrust washer from the hub of the driven support housing.

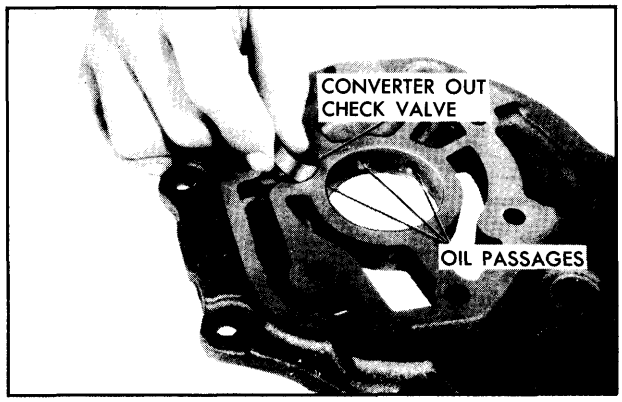


Fig. 7-144 Removing or Installing Check Valve

5. If necessary to remove the drive and driven sprocket support housing assemblies, proceed as follows:

a. Remove the remaining sprocket support to pump cover plate attaching bolts.

b. Support cover plate on wooden blocks and using a plastic mallet, vigorously strike the stator shaft of the drive sprocket support, Fig. 7-145, and the hub of the driven sprocket support, Fig. 7-146, until they are removed from their pump cover plate bores.

CAUTION: When driving the housings out of the pump cover plate avoid damaging or distorting the stator shaft or the ring grooves in the hub of the driven housing.

c. Remove and discard housing to pump cover plate gaskets.

d. Remove converter out check valve, Fig. 7-144.

e. Install converter out check valve.

f. Install drive sprocket support housing to pump cover plate gasket.

g. Install drive sprocket support housing into pump cover plate by using a plastic mallet to seat the housing. Use bolts for guides, Fig. 7-147.

h. Install driven sprocket support housing to pump cover plate gasket.

i. Install driven sprocket support housing to pump cover plate attaching bolts for gasket guides.

j. Install driven sprocket support housing into pump cover plate by using a plastic mallet to seat the housing.

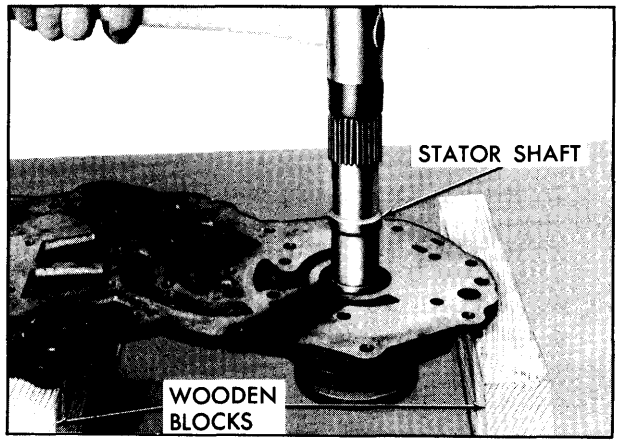


Fig. 7-145 Removing Drive Sprocket Support

BACK TO INDEX

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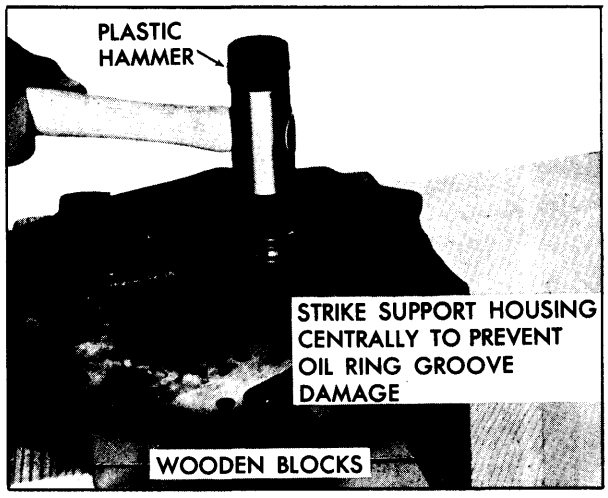


Fig. 7-146 Removing Driven Sprocket Support

k. Install all but one driven support housing to pump cover plate attaching bolts. Torque to 20 ft. lbs.

6. Install proper front unit end play selective thrust washer on the hub of the driven sprocket support housing. Use micrometer to determine the actual thickness of the thrust washer.

7. Install oil seal rings into the grooves in the hub of the driven sprocket support housing Fig. 7-148.

(NOTE: For service the ring is hook type cast iron.)

83. Remove Forward Clutch Assembly, Direct Clutch Assembly, Sun Gear Shaft, and Front Band

1. Remove forward clutch assembly from transmission, Fig. 7-149, by installing Front End Play Checking Tool, J-22241, into forward clutch and lifting forward clutch straight out.

2. Remove forward clutch hub to direct clutch housing thrust washer if it did not come out with forward clutch assembly.

3. Remove direct clutch and intermediate sprag assembly by lifting straight out. Sun gear shaft may come out with direct clutch assembly.

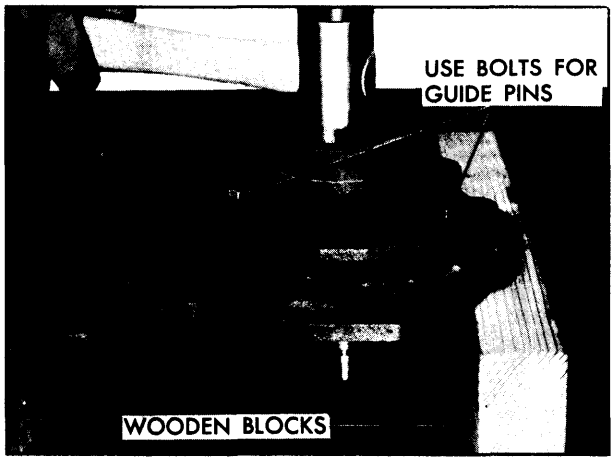


Fig. 7-147 Installing Driven Sprocket Support

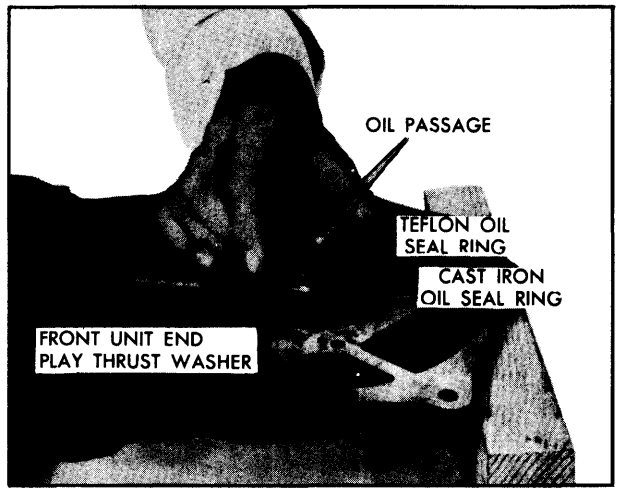


Fig. 7-148 Installing O-Rings on Sprocket Support

4. Remove sun gear shaft if not previously removed.

5. Remove front band assembly.

(NOTE: Check rear unit end play at this time. Proceed as described in Note 84.)

84. Rear Unit End Play Checking Procedure

1. Rotate transmission in holding fixture base so that forward end of transmission is up.

2. Install Speedometer Puller Bolt, J-21797, in one of the differential mounting bolt holes on end of transmission case.

3. Mount Dial Indicator, J-8001, on Bolt J-21797, and index indicator to register with flat surface on end of output flange, Fig. 7-150.

4. Set dial indicator to zero.

5. Using two screw drivers (180° apart) move output flange in and out. Note resulting travel or end play for selection of washer for use at time of transmission assembly. End play should be .007 inch-.019 inch.

(NOTE: Use of two screwdrivers avoids an angled condition and insures greater accuracy.)

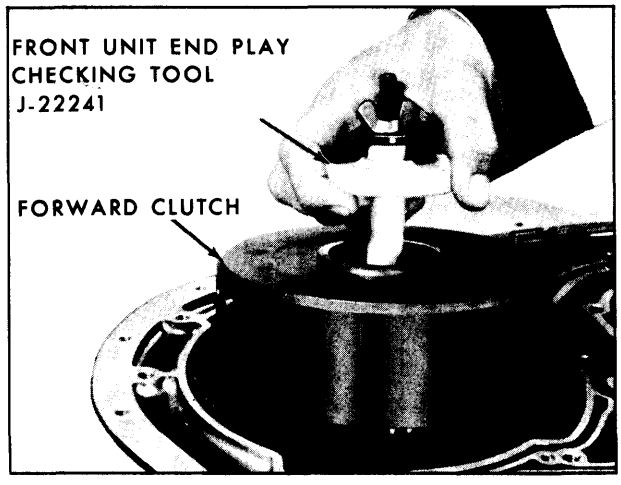


Fig. 7-149 Removing Forward Clutch

BACK TO INDEX

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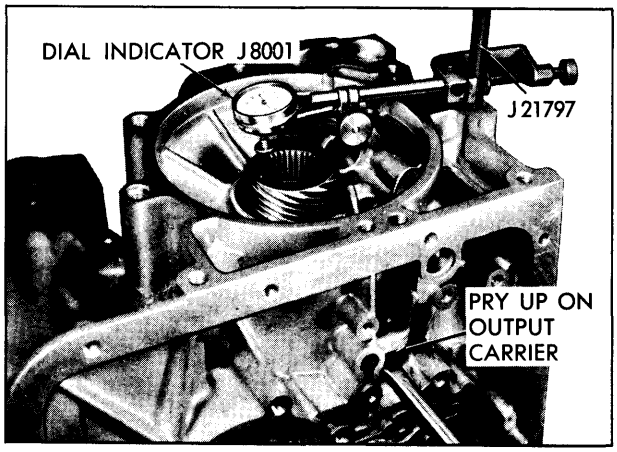


Fig. 7-150 Checking Rear Unit End Play

The selective washer controlling this end play is the steel washer with the three tabs, located between thrust washer and rear face of transmission case. Notches and/or numerals on the tabs serve to identify washer thickness.

If a different washer thickness is required to bring end play within specifications, it can be selected from the following chart. The tabs will show identification notches, numerals or both.

Thickness	Identification Notch and/or Numeral	
.074 - .078	None	1
.082 - .086	On Side of 1 Tab	2
.090 - .094	On Side of 2 Tabs	3
.098 - .102	On End of 1 Tab	4
.106 - .110	On End of 2 Tabs	5
.114 - .118	On End of 3 Tabs	6

6. Remove Dial Indicator, J-8001-02, and Bolt, J-21797, from transmission and rotate transmission so that rear end of transmission is up.

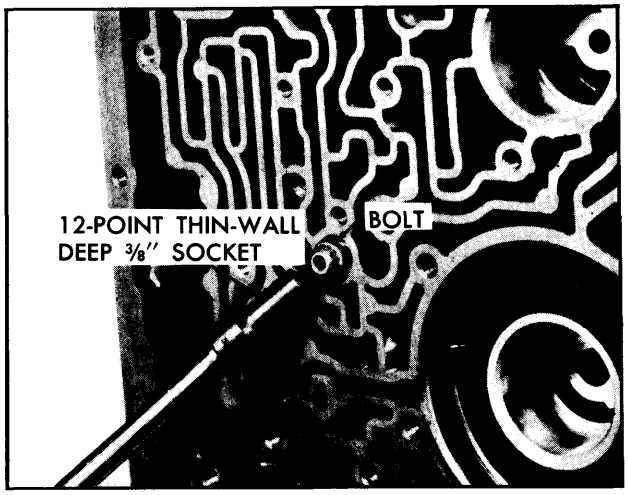


Fig. 7-151 Removing Center Support Bolt

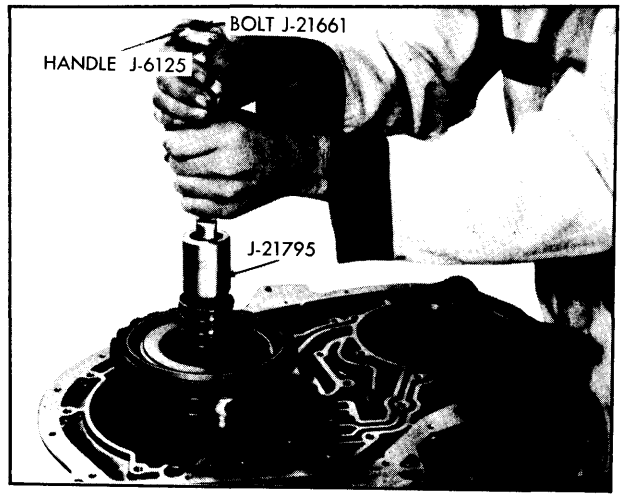


Fig. 7-152 Removing Gear Unit Assembly

85. Remove Remaining Components

1. Remove center support bolt from transmission case, Fig. 7-151, using a 3/8 inch 12-point thin wall deep socket.

2. Remove intermediate clutch backing plate to case snap ring.

3. Remove intermediate clutch backing plate, and three composition faced and three steel clutch plates.

4. Using a needle-nose pliers, or screwdriver, remove center support to case snap ring, Fig. 7-153.

5. Install Gear Assembly Remove and Installer Adapter, J-21795-02, on end of main shaft so that tangs engage groove in shaft. Using Slide Hammer Handle, J-6125, and Speedometer Puller Bolt, J-21797, tighten bolt on tool to secure tool on shaft, Fig. 7-152.

6. Remove complete gear unit assembly from case, by lifting straight up.

CAUTION: Be careful not to drop or bump assembly in transmission case during removal.

7. Remove output flange to case metal thrust washer from output flange or case.

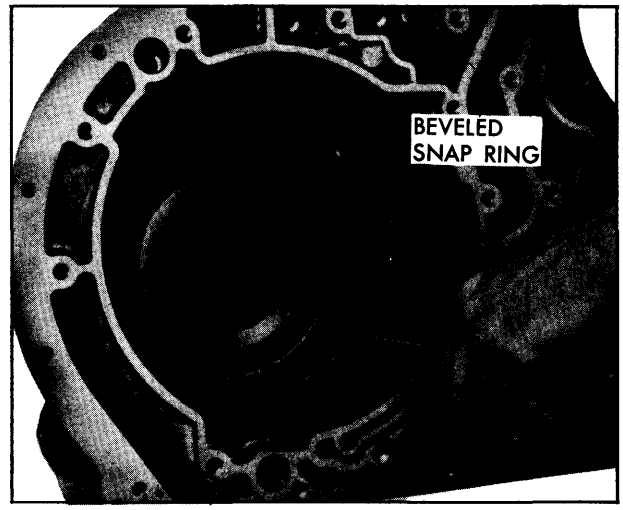


Fig. 7-153 Removing Snap Ring

BACK TO INDEX

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8. Place gear unit assembly on bench with output flange down, Fig. 7-154. Remove Tool J-21795.
9. Remove support to case spacer, Fig. 7-176.
10. Remove rear band assembly. To facilitate removal, rotate band lugs away from pins and pull band assembly out of transmission case.
11. Remove rear unit selective washer from transmission case.

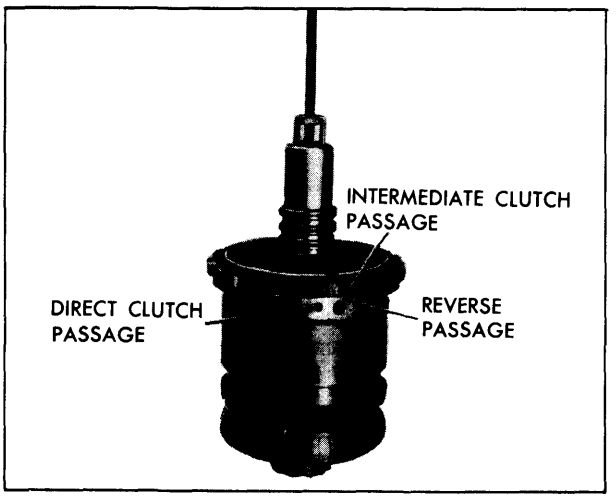


Fig. 7-154 Gear Unit Bench Position

INDIVIDUAL UNIT DISASSEMBLY, CLEANING, INSPECTION, ASSEMBLY AND INSTALLATION OF MAJOR COMPONENTS

86. Inspection of Transmission Case

1. Inspect case assembly for cracks, porosity or interconnected passages, Fig. 7-117.
2. Check for good retention of band anchor pins.
3. Inspect all threaded holes for thread damage.
4. Inspect intermediate clutch plate lugs for damage or brinelling.
5. Inspect snap ring grooves for damage.
6. Inspect governor assembly bore for scratches or scoring.
7. Inspect governor pipes screen assemblies (located in governor pipe holes in case) for plugging or damage.
8. Inspect modulator valve bore for scoring or damage.
9. Inspect output flange bushing for wear, galling and open lubrication groove.

87. Center Support and Gear Unit

a. Disassembly

1. Remove center support assembly from reaction carrier by lifting center support straight up.
2. Remove center support to reaction carrier thrust washer.

(NOTE: Thrust washer may have stuck to back of center support. If so, remove from center support.)

3. Remove reaction carrier and roller clutch assembly from output carrier, Fig. 7-155, and remove roller clutch assembly from reaction carrier.
4. Remove center support to sun gear races and thrust bearing from sun gear.

(NOTE: One of the races may have stuck to back of center support.)

5. Remove front internal gear ring from output carrier assembly, Fig. 7-156.
6. Remove sun gear from output carrier assembly.
7. Remove reaction carrier to output carrier thrust washer from output carrier.
8. Invert gear unit and place in Rear Unit Holding Fixture, J-6116-01, with main shaft pointing downward.
9. Remove snap ring securing output flange to output carrier and remove output flange.
10. Remove thrust bearing and races from rear internal gear.
11. Lift rear internal gear and main shaft out of output carrier and remove thrust bearing and races from inner face of rear internal gear.
12. Remove snap ring from end of main shaft and remove rear internal gear.
13. Remove output carrier from holding fixture.

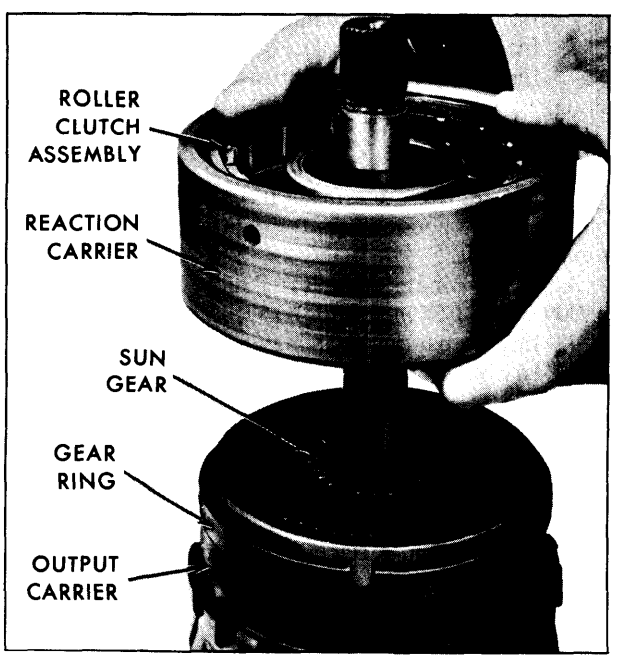


Fig. 7-155 Removing Reaction Carrier and Roller Clutch

BACK TO INDEX

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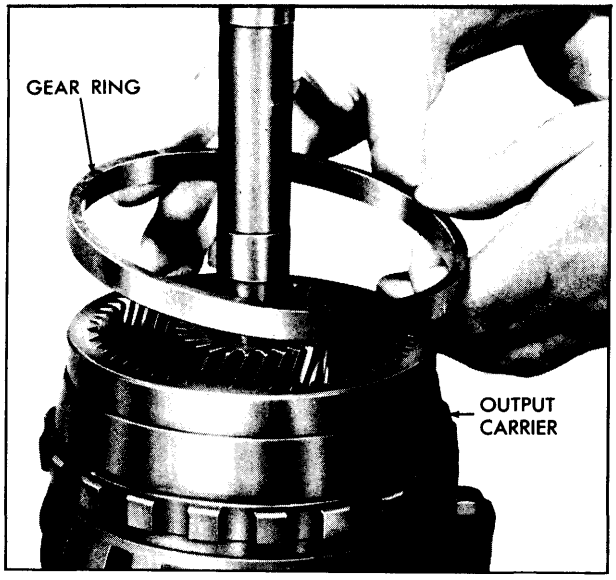


Fig. 7-156 Removing Front Internal Gear Ring

b. Inspect Output Flange

1. Inspect bearing and thrust washer surfaces for damage.
2. Inspect drive lugs for damage.
3. Inspect splines for damage.
4. Inspect lubrication passages.

c. Inspect Main Shaft

1. Inspect shaft for cracks or distortion.
2. Inspect splines for damage.
3. Inspect ground bushing journals for damage.
4. Inspect snap ring groove for damage.
5. Inspect lubrication passages.

d. Inspect Rear Internal Gear

1. Inspect gear teeth for damage or wear.
2. Inspect splines for damage.
3. Inspect gear for cracks.
4. Inspect bearing and thrust surfaces for wear or galling.

e. Inspect Output Carrier

1. Inspect front internal gear for damaged teeth.
2. Inspect pinion gears for damage, rough bearings or excessive tilt.
3. Check pinion end play. Pinion end play should be .009 inch - .024 inch, Fig. 7-157.
4. Inspect parking gear lugs for cracks or damage.
5. Inspect output flange locating splines for damage.
6. Inspect front internal gear ring for flaking or cracks.

f. Inspect Reaction Carrier

1. Inspect band surface on reaction carrier for signs of burning or scoring.
2. Inspect roller clutch outer cam for scoring or wear.
3. Inspect thrust washer surfaces for signs of scoring or wear.

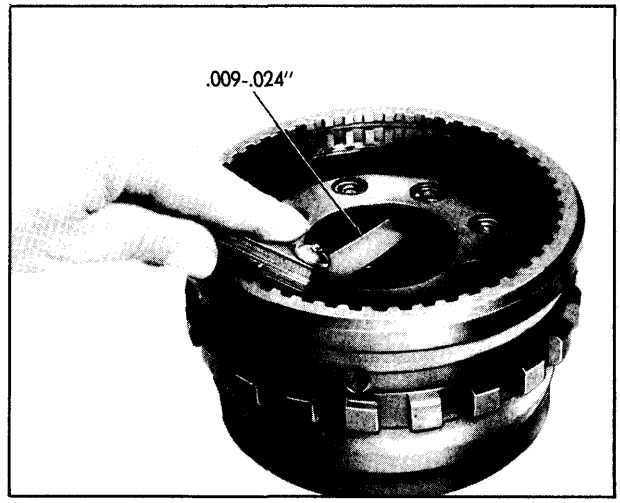


Fig. 7-157 Checking Pinion End Play

4. Inspect bushing for damage. If bushing is damaged, carrier must be replaced.
5. Inspect pinion gears for damage, rough bearings or tilt.
6. Check pinion end play. Pinion end play should be .009 inch - .024 inch.

g. Pinion Gear Replacement - Reaction and Output Carrier Assemblies

1. Support carrier assembly on its FRONT face.
2. Using a 1/2 inch diameter drill remove the stake marks from the end of the pinion pin, or pins, to be replaced. This will reduce the probability of cracking the carrier when the pinion pins are pressed out.

CAUTION: Do not allow drill to remove any stock from the carrier, as this will weaken the part, and could result in a cracked carrier.

3. Using a tapered punch, drive or press pinion pins out of carrier.
4. Remove pinion gears, thrust washers, and roller needle bearings.
5. Inspect pinion pocket thrust faces for burrs and remove if present.
6. Install eighteen needle bearings into each pinion gear using petrolatum to hold bearings in place. Use a pinion pin as a guide.
7. Place a bronze and steel thrust washer on each side of pinion gear with steel washers against gear, Fig. 7-158. Hold washers in place with petrolatum.
8. Place pinion gear assembly in position in carrier and install a pilot shaft through rear face of assembly to hold parts in place.
9. Drive a new pinion pin into place from the front, while rotating pinion gear. Be sure that headed end is flush or below face of carrier.
10. Using a punch in bench vise for an anvil, stake opposite end of pinion pin in three places with a blunt radius chisel, Fig. 7-159.

(NOTE: Both ends of pinion pins must lie below face of carrier or interference may occur.)

11. Repeat installation procedure for each pinion gear.

BACK TO INDEX

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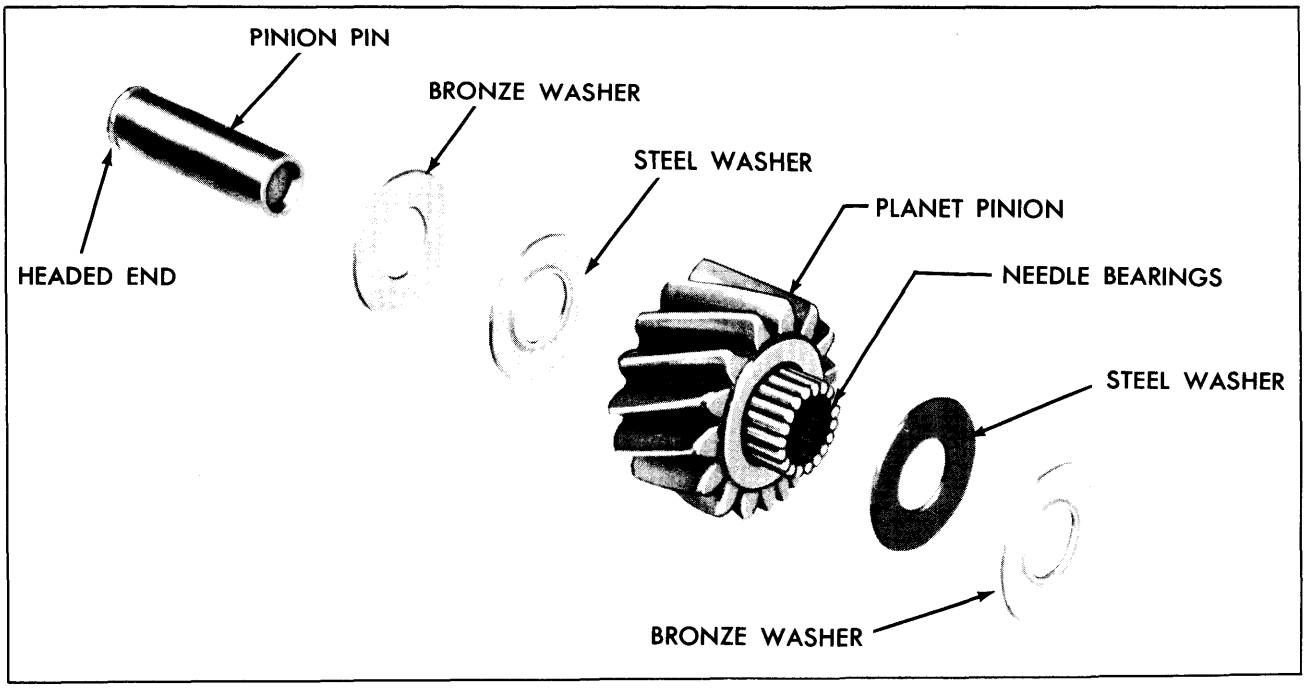


Fig. 7-158 Planet Pinion—Disassembled View

h. Inspect Roller Clutch

1. Inspect roller clutch for damaged rollers or springs.
2. Inspect roller clutch cage for damage.

i. Inspect Sun Gear

1. Inspect gear teeth for damage or wear.
2. Inspect splines for damage.
3. Be sure oil lubrication hole is open.

j. Inspect Sun Gear Shaft

1. Inspect shaft for cracks or splits.
2. Inspect splines for damage.

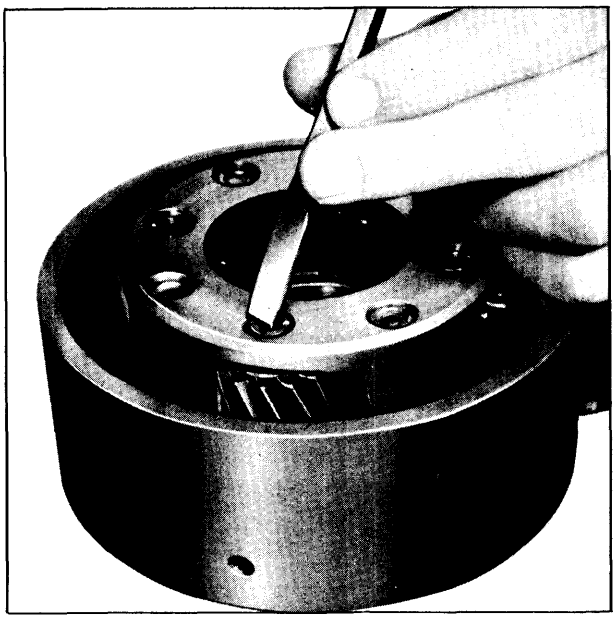


Fig. 7-159 Staking Pinion Pin

3. Inspect bushings for scoring or galling.
4. Inspect ground bushing journals for damage.
5. Be sure oil lubrication hole is open.

k. Assemble Gear Unit (Fig. 7-160)

1. Install rear internal gear on end of main shaft that has snap ring groove and install snap ring.
2. Install races and thrust bearing on inner face of rear internal gear, retaining races and bearing with petrolatum. Proceed as follows:
   a. Install large diameter race first, with flange facing up, Fig. 7-161.
   b. Install thrust bearing in race.
   c. Install small diameter race on bearing with inner flange facing down.
3. Lubricate pinion gears in output carrier with transmission fluid and install output carrier on main shaft so that pinion gears mesh with rear internal gear.
4. Place assembly in a Rear Unit Holding Fixture, J-6116, with main shaft pointing downward. Be careful not to damage shaft.
5. Install races and thrust bearing on outer face of rear internal gear, retaining races and bearing with petrolatum. Proceed as follows:
   a. Install small diameter (flanged I.D.) race first, with flange facing up, Fig. 7-162.
   b. Install thrust bearing in race.
   c. Install large diameter (flanged O.D.) race on bearing with flange cupped over bearing.
6. Install output flange into output carrier and install snap ring.
7. Invert assembly and place on bench with output flange downward.
8. Lubricate tab side of reaction carrier to output carrier non-metal or metal thrust washer with petrolatum and install thrust washer in output carrier with tabs in tab pockets.

BACK TO INDEX

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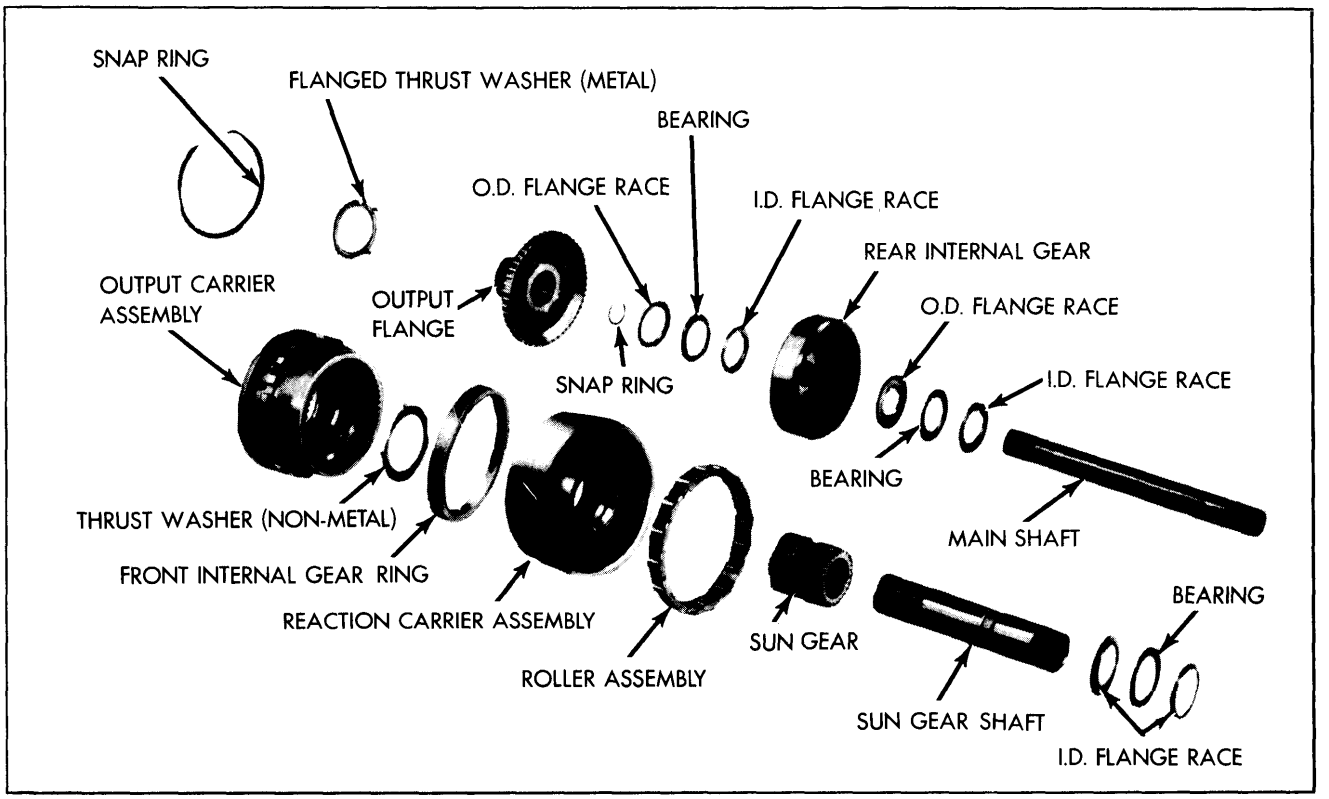


Fig. 7-160 Gear Unit—Disassembled View

9. Install sun gear with end having chamfered I.D. facing down.

10. Install sun gear shaft with longer splined end down.

11. Install gear ring over output carrier.

12. Lubricate pinion gears in reaction carrier with transmission fluid and install reaction carrier on output carrier so that pinion gears mesh with front internal gear.

(NOTE: When a new output carrier and/or reaction carrier is being installed, and if the front internal gear ring prevents assembly of the carriers, replace the front internal gear ring with the service ring. The front internal gear ring is a selective fit at the factory, but not in service.)

13. Install large diameter O.D. race on sun gear with flange facing up against sun gear shaft.

14. Install thrust bearing on race.

15. Lubricate small diameter race with petrolatum and install race on center support with flange facing toward tower end, Fig. 7-163.

16. Install rollers that may have come out of roller clutch cage, by compressing energizing spring with fore-

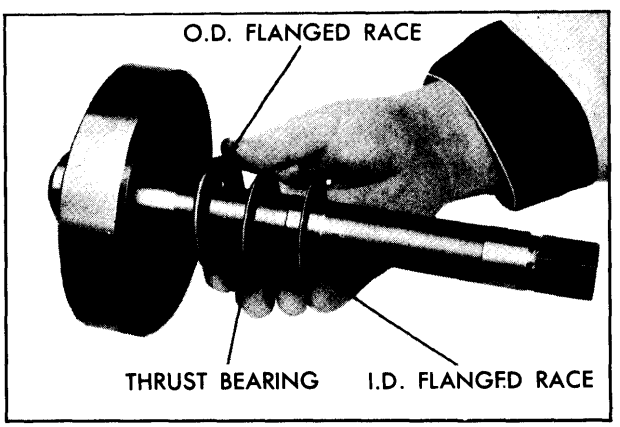


Fig. 7-161 Installing Thrust Bearing on Inner of Rear Internal Gear

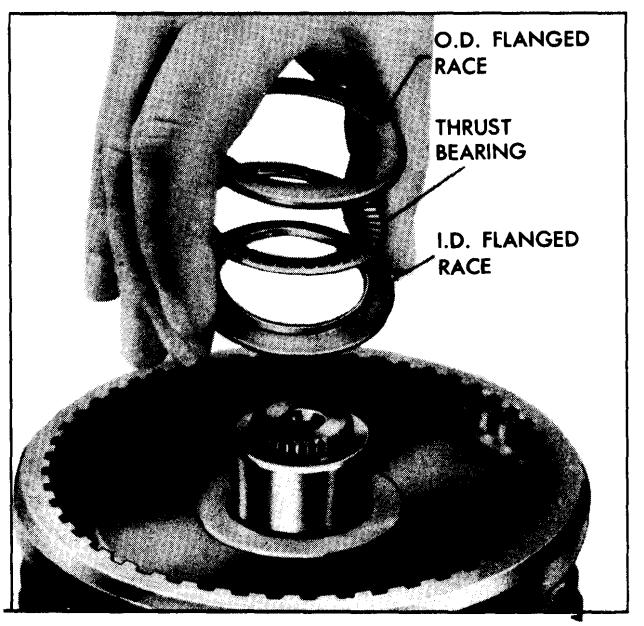


Fig. 7-162 Installing Thrust Bearing on Outer Face of Rear Internal Gear

BACK TO INDEX

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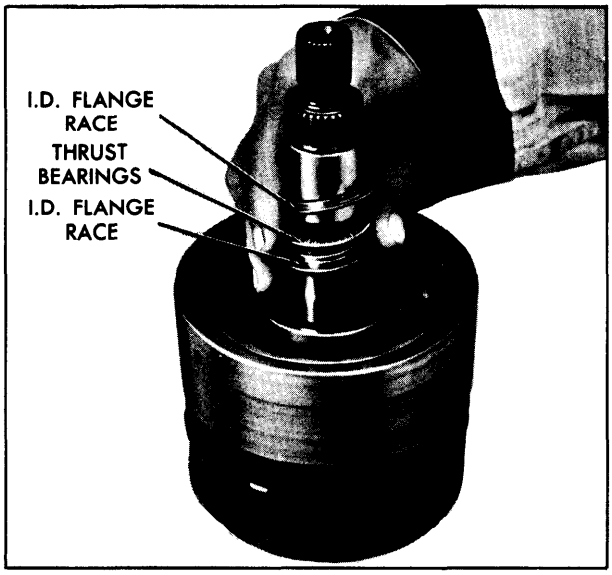


Fig. 7-163 Installing Thrust Bearing Over Sun Gear Shaft

finger and inserting roller from outer side, Fig. 7-164.

(NOTE: Make certain that energizing springs are not distorted, and that curved end leaf of springs are positioned against rollers.)

17. Install roller clutch assembly in reaction carrier, Fig. 7-165.

l. Disassemble Center Support and Intermediate Clutch Piston

1. Remove center support to reaction carrier thrust washer from recess in center support.
2. Remove four oil seal rings from the center support, Fig. 7-166. All service center support oil seal rings are hook type cast iron.
3. Using Clutch Spring Compressor, J-4670-01, and Rear Clutch Spring Compressor, J-6129, Fig. 7-167, compress spring retainer and remove snap ring with Snap Ring Pliers, J-8059 or J-5586.
4. Remove spring retainer, six intermediate clutch release springs, and spring guide.
5. Remove intermediate clutch piston from center support.
6. Remove inner and outer seals from clutch piston.

(NOTE: Do not remove the three screws retaining roller clutch inner race to center support.)

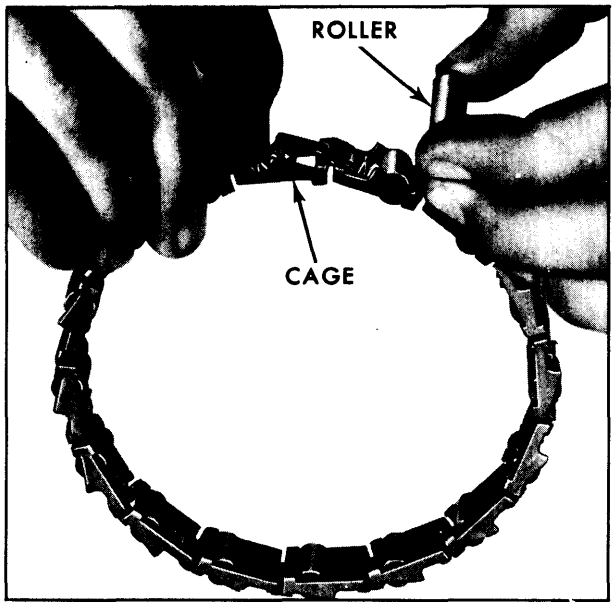


Fig. 7-164 Installing Rollers in Cage

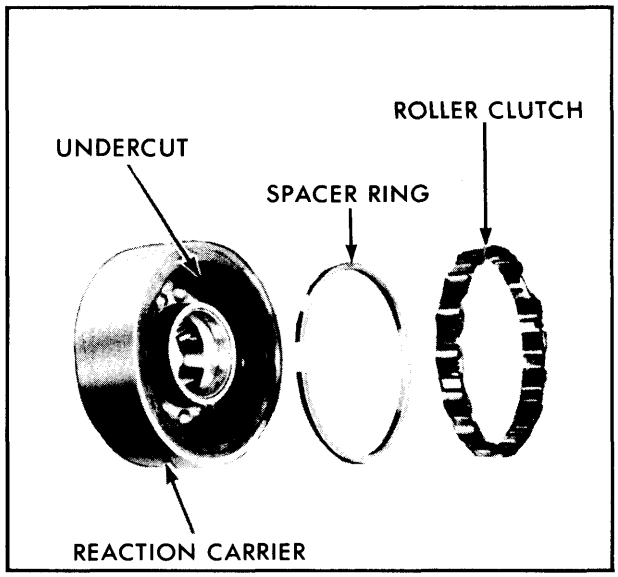


Fig. 7-165 Installing Spacer Ring and Roller Clutch Assembly

m. Inspect Center Support

1. Inspect roller clutch inner race for scratches or indentations. Be sure lubrication hole is open.
2. Inspect bushing for scoring, wear or galling.
3. Check oil ring grooves for damage.
4. Air check oil passages to be sure they are open and not interconnected.

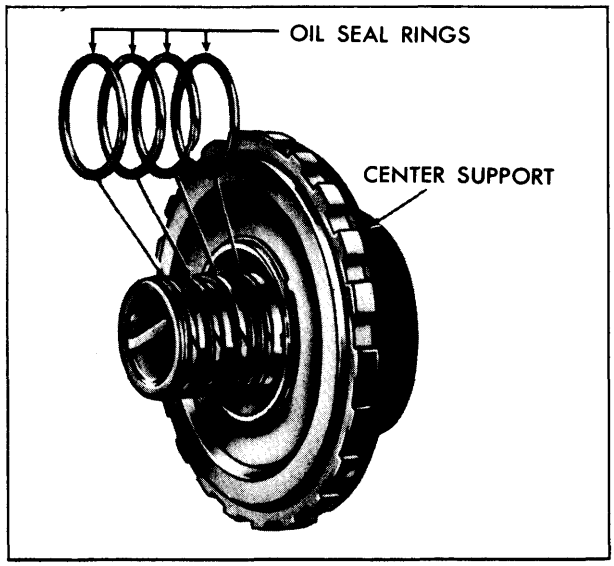


Fig. 7-166 Center Support Oil Seal Rings

BACK TO INDEX

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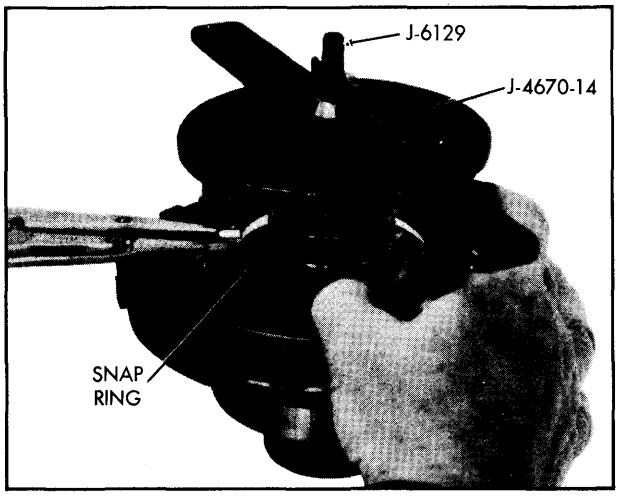


Fig. 7-167 Removing Intermediate Clutch Snap Ring

5. Inspect piston sealing surfaces for scratches.
6. Inspect piston seal grooves for nicks or other damage.
7. Inspect piston for cracks.
8. Inspect springs for collapsed coils or signs of distortion.
9. Inspect oil seal rings for damage.

(NOTE: All service center support oil seal rings are hook type cast iron.)

n. Assemble Center Support and Intermediate Clutch Piston Assembly (Fig. 7-168)

1. Lubricate new inner and outer clutch piston seals with transmission fluid. Lubricate seal grooves in intermediate clutch piston and install seals with lips facing away from spring guide, Fig. 7-169.
2. Place Intermediate Clutch Inner Seal Protector, J-21363, over center support hub, Fig. 7-170, and install intermediate clutch piston.
3. Install plastic spring guide, Fig. 7-171.
4. Install six clutch release springs equally spaced into spring holes in spring guide, Fig. 7-172.
5. Place spring retainer and snap ring over springs.
6. Using Clutch Spring Compressor, J-4670-06, and Rear Clutch Spring Compressor, J-6129, Fig. 7-167,

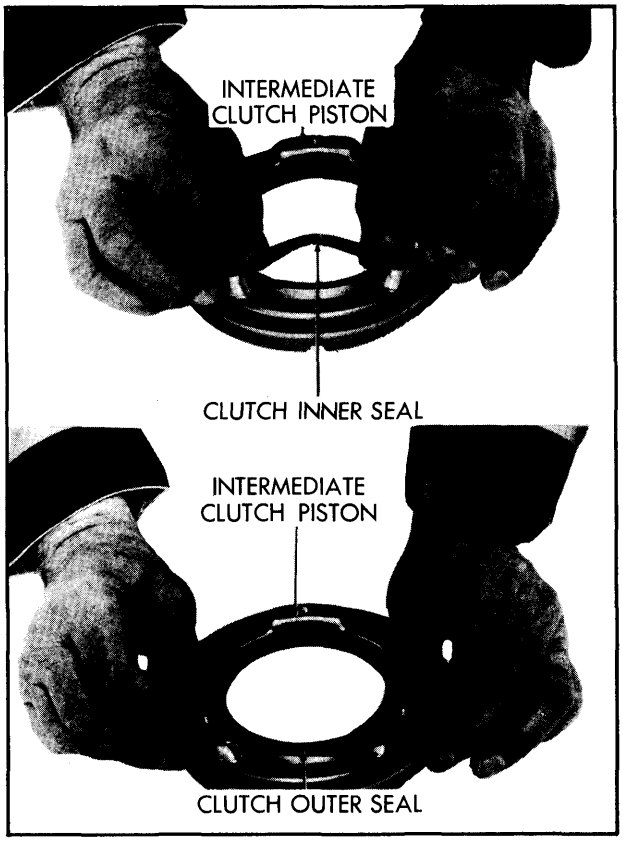


Fig. 7-169 Installing Intermediate Clutch Piston Seals

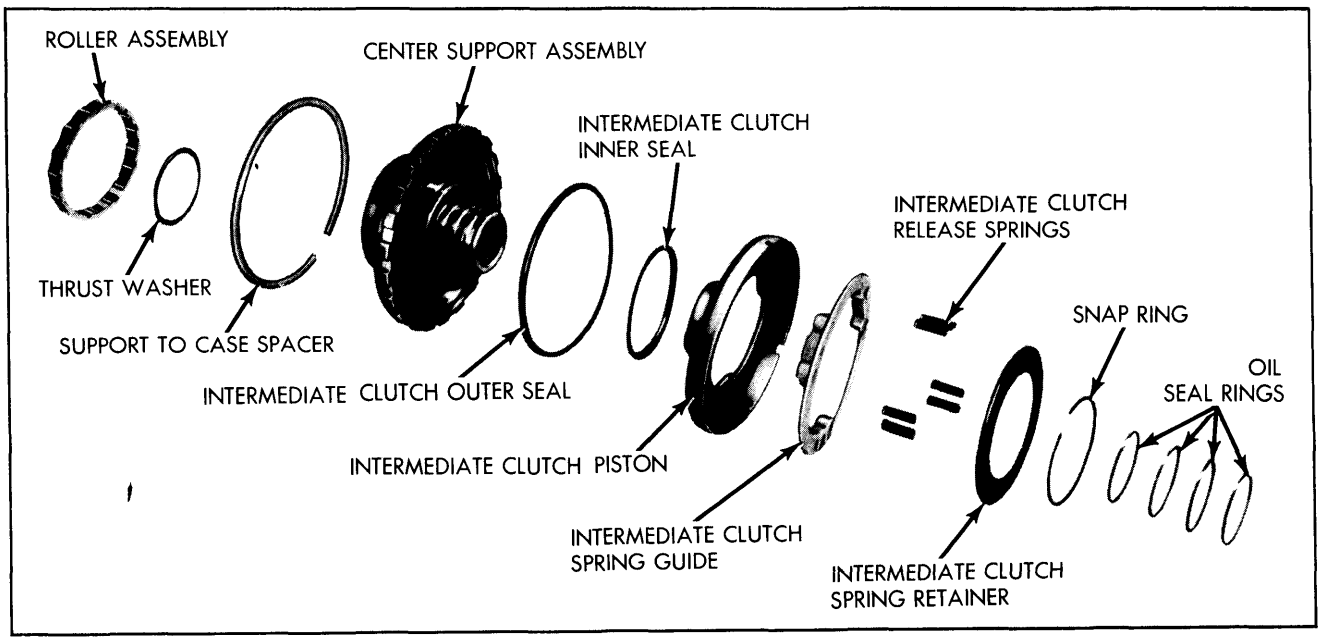


Fig. 7-168 Center Support Assembly—Disassembled View

BACK TO INDEX

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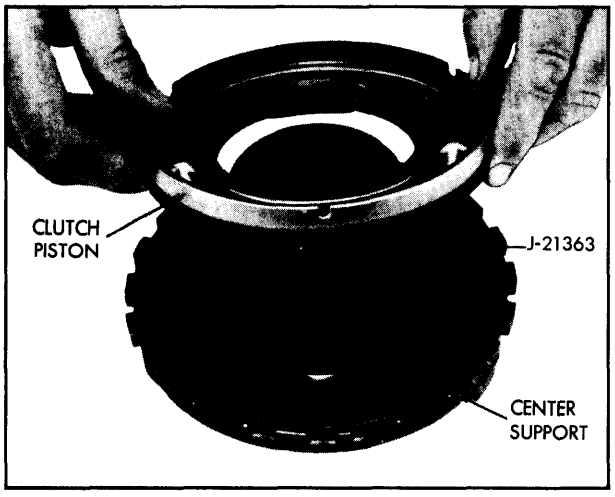


Fig. 7-170 Installing Intermediate Clutch Piston

compress spring retainer, being careful that retainer does not get caught in snap ring groove, and install snap ring with Snap Ring Pliers, J-8059 or J-5586. Remove tools.

7. Install four oil seal rings on the center support.

8. Air check operation of intermediate clutch piston. Apply air through center oil feed hole to actuate clutch piston, Fig. 7-173.

9. Lubricate center support to reaction carrier thrust washer with petrolatum and install washer in recess of center support, Fig. 7-174. Check to make sure sun gear thrust bearing race is on center support.

10. Install center support assembly into roller clutch in reaction carrier, Fig. 7-175.

(NOTE: With reaction carrier held, center support should turn clockwise only.)

11. Install Gear Assembly Remover and Installer Adapter, J-21795-02, on end of main shaft so that tangs engage groove in shaft. Using Slide Hammer Handle, J-6125, and Speedometer Puller Bolt, J-21797, tighten bolt on tool to secure tool on shaft and prevent movement of the roller clutch during installation of the gear unit assembly, Fig. 7-152.

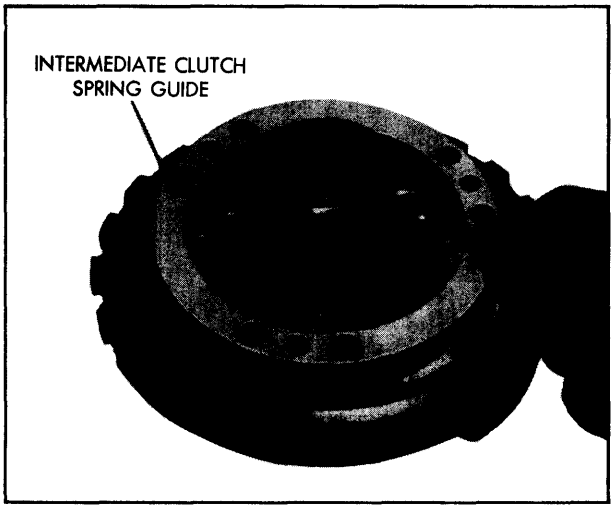


Fig. 7-171 Installing Spring Guide

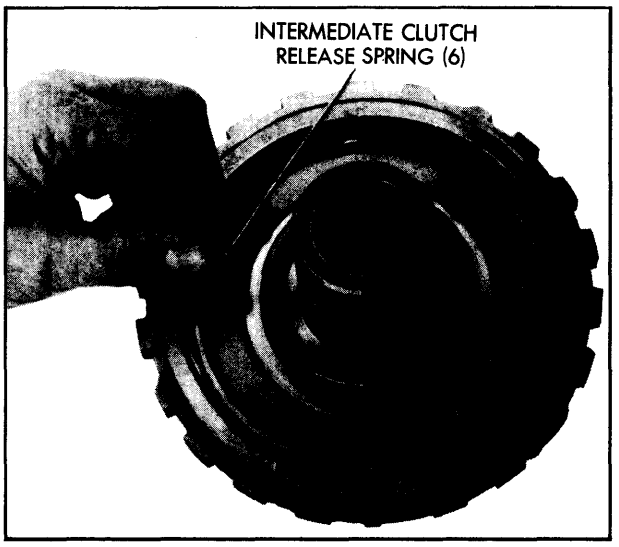


Fig. 7-172 Installing Clutch Spring Release Springs

o. Install Rear Band and Complete Gear Unit Assembly

1. Inspect rear band for cracks or distortion and band ends for damage to anchor lugs and apply lug. Also inspect lining for cracks, flaking, burning and looseness.

2. Install rear band assembly in transmission case so that band lugs index with anchor pins.

3. Inspect support to case spacer for burrs or raised edges. If present, remove with a stone or fine sandpaper.

4. Install the support case spacer against the shoulder at the bottom of case splines and the gap located adjacent to the band anchor pin, Fig. 7-176.

CAUTION: Do not confuse this spacer (.040" thick and both sides flat) with either the center support to case snap ring (one side beveled) or the intermediate clutch backing plate to case snap ring (.093" thick and both sides flat).

5. Install previously selected rear unit selective washer into slots provided inside rear of transmission case. Retain washer with petrolatum.

(NOTE: Proper washer size was determined at time of rear unit end play check.)

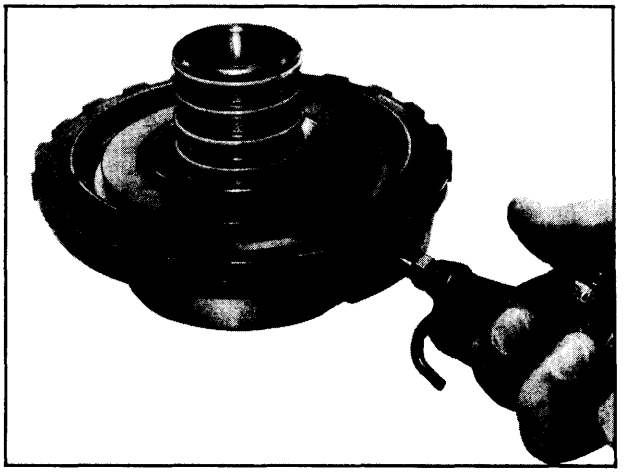


Fig. 7-173 Air Checking Intermediate Clutch

BACK TO INDEX

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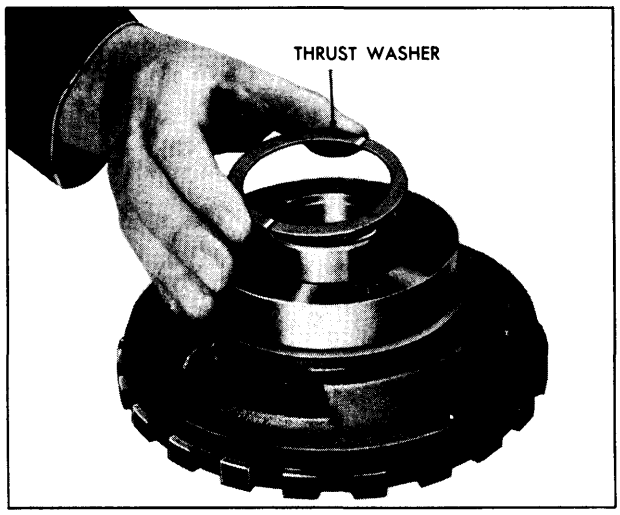


Fig. 7-174 Installing Center Support-to-Reaction Carrier Thrust Washer

6. Laying gear unit on its side, install metal thrust washer on output flange with bent tabs in tab pockets. Retain thrust washer with petrolatum.

CAUTION: This must be a metal thrust washer.

CAUTION: Be careful not to drop or bump gear unit assembly in transmission case during installation.

7. Install gear unit, with center support and reaction carrier, by lining up center support bolt hole with hole in case and carefully guiding complete assembly into transmission case.

8. Lubricate center support to case snap ring with transmission fluid and install snap ring in transmission case with beveled side up, (flat side against center support) locating gap adjacent to front band anchor pin. Expand snap ring until center support is against shoulder of case.

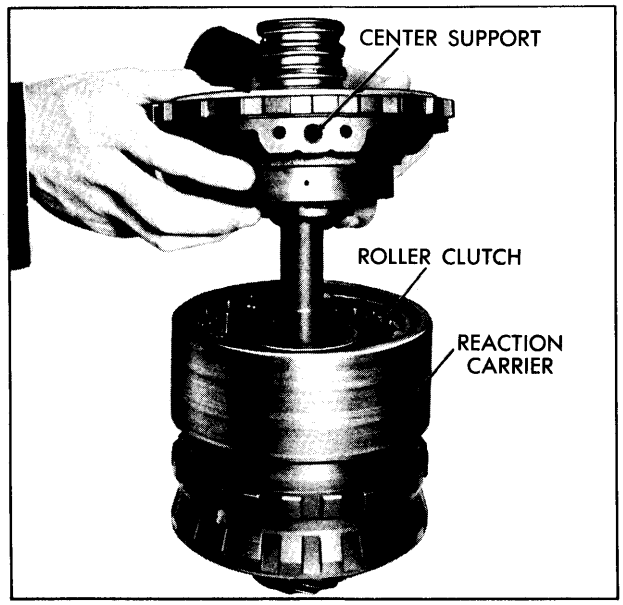


Fig. 7-175 Installing Center Support to Reaction Carrier

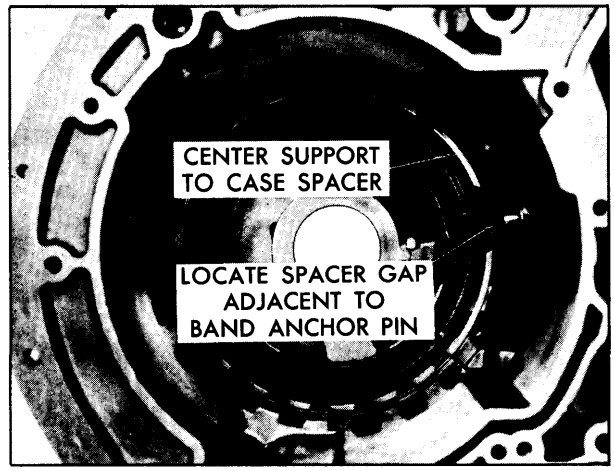


Fig. 7-176 Installing Support-to-Case Spacer

9. Install case to center support bolt.

(NOTE: To correctly perform this operation, it will be necessary to make the tool shown in Fig. 7-101. Then follow procedure outlined below:)

Place center support locating tool into the case direct clutch passage, with the handle of the tool pointing to the left, as viewed from the front of transmission and parallel to the bell housing mounting, Fig. 7-177.

Lift upward on the tool which will tend to rotate the center support counterclockwise as viewed from the front of transmission. While holding the center support firmly counterclockwise against case splines, torque case to center support bolt to 23 ft. lbs., using a 3/8" 12-point thin-wall deep socket.

CAUTION: When using the locating tool, care should be taken not to raise burrs on the case valve mounting face.

10. Before installing intermediate clutch plates, inspect plates for signs of burning, scoring, and wear.

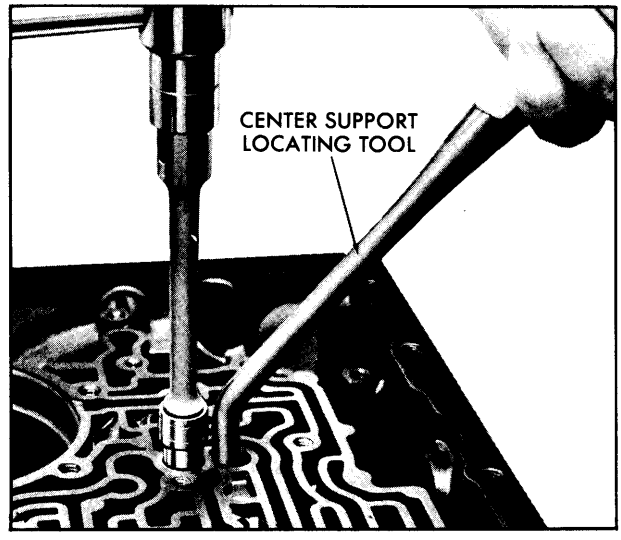


Fig. 7-177 Locating Center Support

BACK TO INDEX

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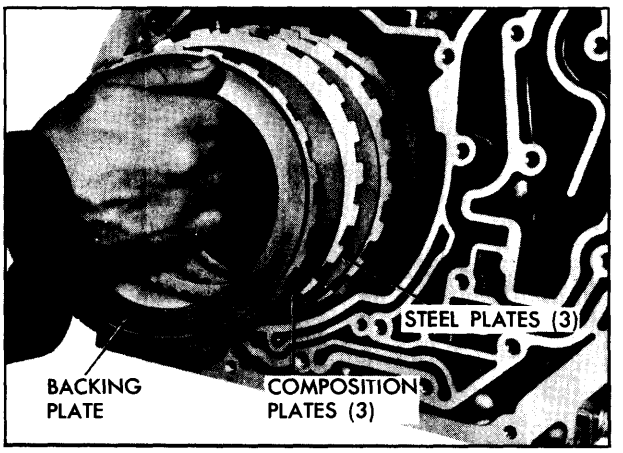


Fig. 7-178 Installing Intermediate Clutch Plates

11. Lubricate three steel and three composition faced intermediate clutch plates with transmission fluid and install clutch plates in transmission case, Fig. 7-178. Start with steel plate and alternate composition faced and flat steel plates.

12. Install intermediate clutch backing plate with flat machine surface against clutch plates.

13. Install backing plate to case snap ring with snap ring gap on side of case opposite front band anchor pin.

(NOTE: Both sides of this snap ring are flat, and it is approximately .093" thick.)

14. Recheck rear unit end play as described in Note 84.

88. Direct Clutch and Intermediate Sprag Assembly (Fig. 7-179)

a. Disassembly

1. Remove sprag retainer snap ring, and remove clutch retainer.
2. Remove sprag outer race and bushings, and remove sprag assembly from outer race.
3. Turn unit over and remove direct clutch backing plate to clutch housing snap ring.
4. Remove direct clutch backing plate and six composition and six steel clutch plates, Fig. 7-180.
5. Using Clutch Spring Compressor, J-4670-01, Rear Clutch Spring Compressor, J-6129, or an arbor press, and Adapter, J-21664, Fig. 7-181 compress spring retainer and remove snap ring with Snap Ring Pliers, J-8059 or J-5586.
6. Remove tools, spring retainers, and fourteen clutch release springs. Keep springs separate from forward clutch springs.
7. Remove direct clutch piston from direct clutch housing.
8. Remove inner and outer seals from clutch piston.
9. Remove center piston seal from direct clutch housing.

b. Inspection

1. Inspect sprag assembly for popped or loose sprags.
2. Inspect sprag bushing for wear or distortion.
3. Inspect inner and outer races for scratches or wear.

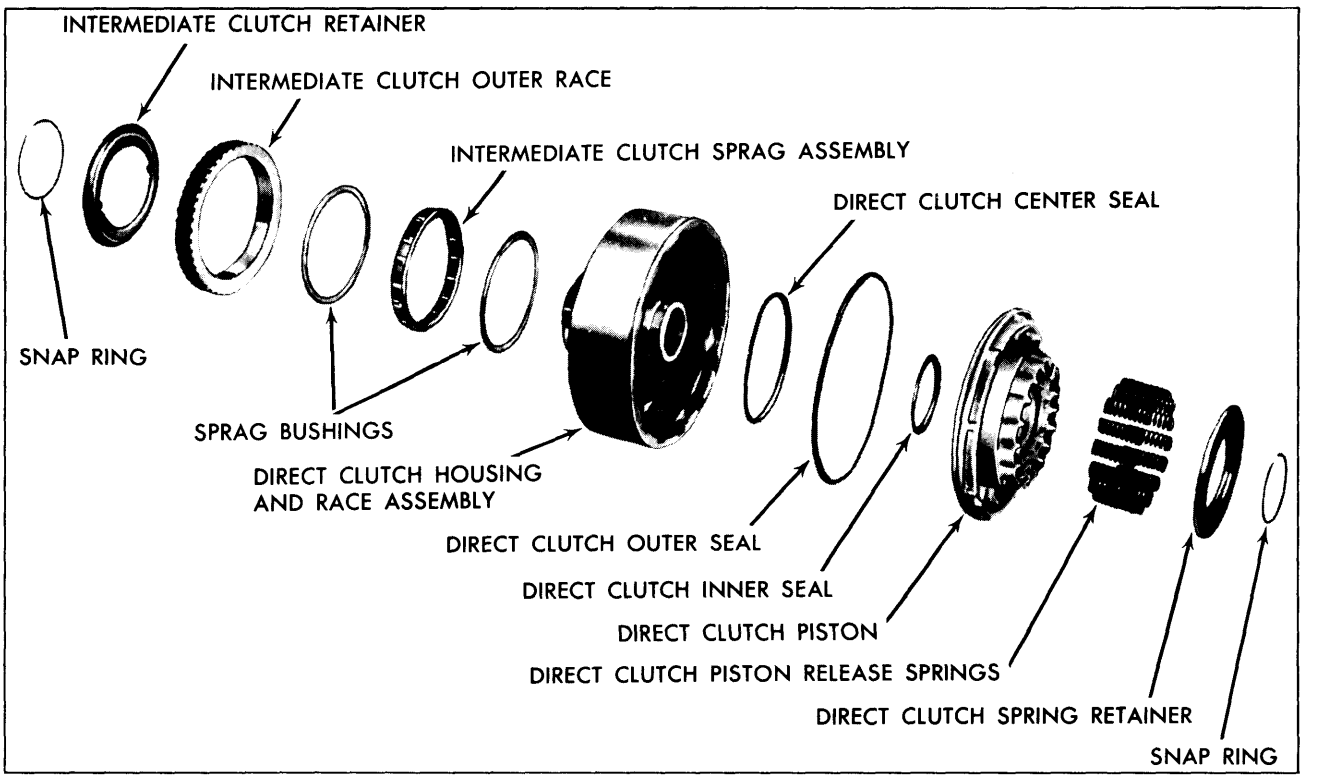


Fig. 7-179 Direct Clutch and Piston—Disassembled View

BACK TO INDEX

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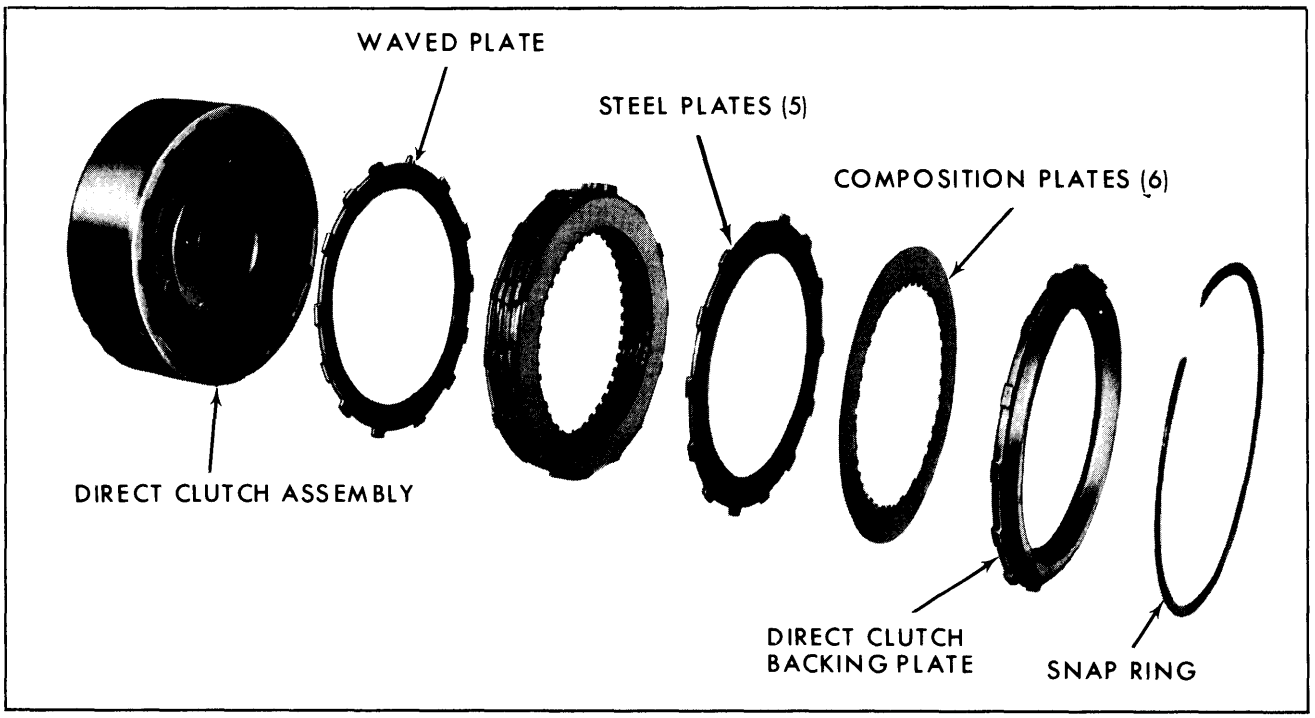


Fig. 7-180 Direct Clutch—Disassembled View

4. Inspect clutch housing for cracks, wear, proper openings of oil passages and wear on clutch plate lugs.
5. Inspect composition faced and steel clutch plates for sign of wear or burning.
6. Inspect backing plate for scratches or other damage.
7. Inspect piston for cracks and free operation of ball check.
8. Inspect springs for collapsed coils or signs of distortion.
9. Inspect housing for free operation of check ball.

(NOTE: The 14 direct clutch release springs are not serviced individually. If one or more of these springs require replacement, discard all of them and install the 16 service direct clutch release springs.)

c. Assembly

1. Lubricate new inner and outer clutch piston seals with transmission fluid. Lubricate seal grooves in direct clutch piston and install seals with lips facing away from spring pockets.
2. Lubricate new center seal with transmission fluid. Lubricate seal groove in direct clutch housing and install seal in clutch housing with lip facing up.
3. Place Forward and Direct Clutch Inner Seal Protector, J-21362, over direct clutch hub. Install clutch piston inside Forward and Direct Clutch Piston Installer, J-21409, insert assembly in direct clutch housing Fig. 7-183 and install clutch piston by rotating it slightly, in a clockwise direction.
4. Install 14 clutch release springs into spring pockets in clutch piston (16 if service springs).
5. Place spring retainer and snap ring over springs.
6. Using Clutch Spring Compressor, J-4670-01, Rear Clutch Spring Compressor, J-6129, or an arbor

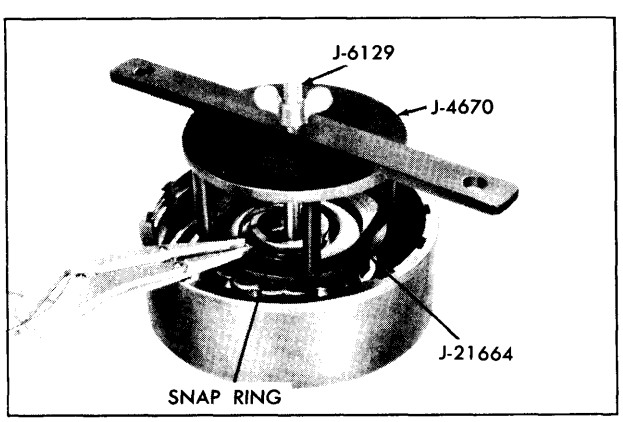


Fig. 7-181 Removing Direct Clutch Snap Ring

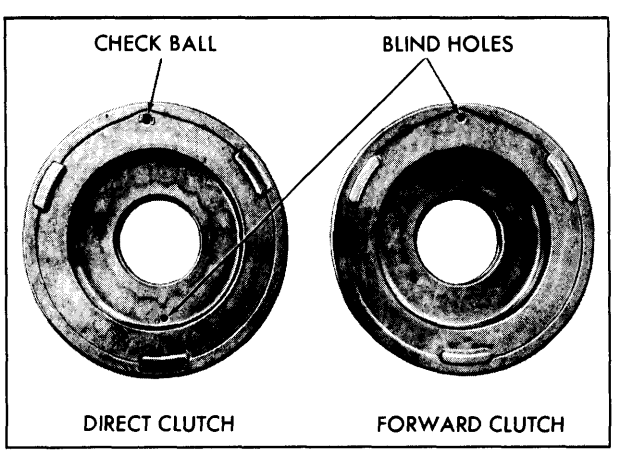


Fig. 7-182 Direct Clutch Identification

BACK TO INDEX

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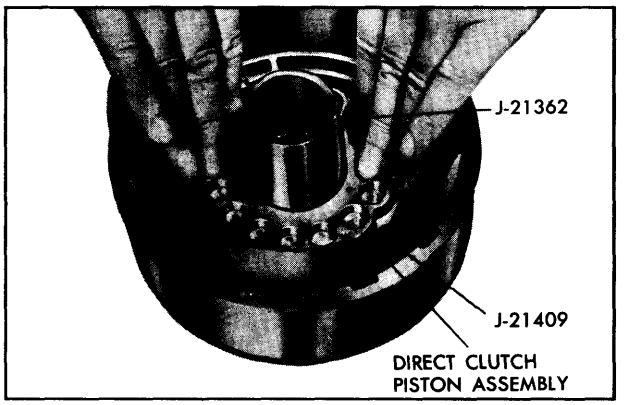


Fig. 7-183 Installing Direct Clutch Piston

press, and Adapter, J-21664, Fig. 7-181, compress spring retainer, being careful that retainer does not get caught in snap ring groove, and install snap ring with Snap Ring Pliers, J-8059 or J-5586. Remove tools.

(NOTE: Make certain clutch release springs are not leaning. If necessary, straighten springs with a small screwdriver.)

7. Lubricate the five flat and one waved (plate with "U" notch) steel and six composition faced clutch plates with transmission fluid and install clutch plates in direct clutch housing. Start with waved steel plate and alternate composition and flat steel clutch plates. Fig. 7-184.

8. Install direct clutch backing plate over clutch plates and install backing plate snap ring.

9. Invert clutch housing and install one sprag bushing, cup side up, around sprag inner race.

10. Install sprag assembly into clutch outer race.

11. With ridge on inner cage of sprag facing up install sprag and outer race on inner race with counterclockwise turning motion.

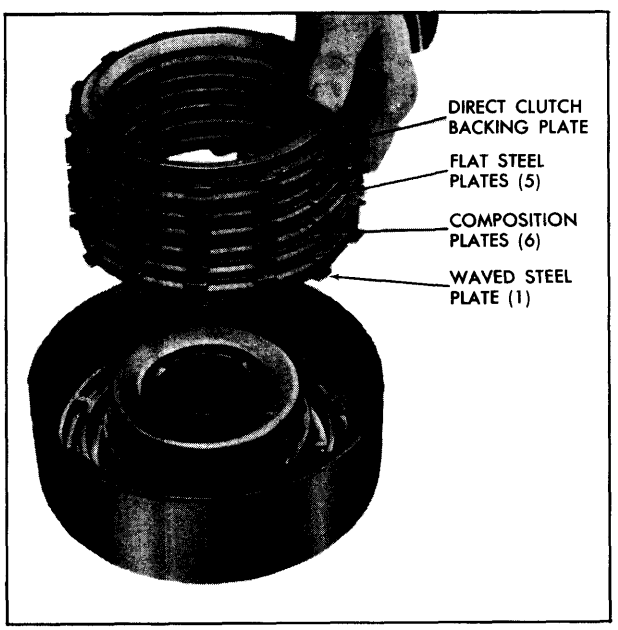


Fig. 7-184 Installing Direct Clutch Plates

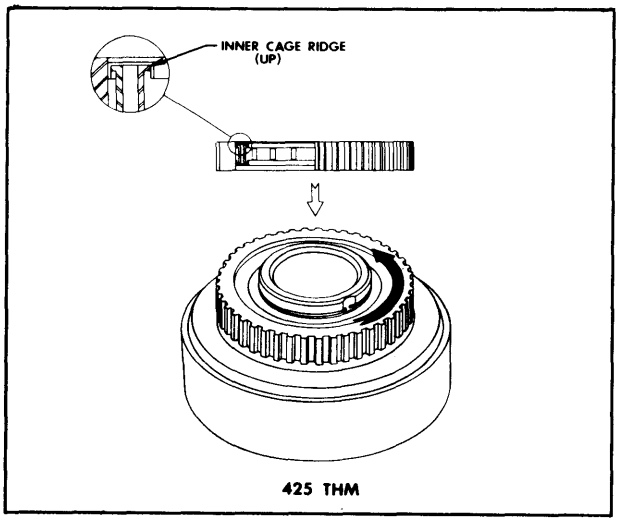


Fig. 7-185 Sprag Rotation

(NOTE: When installed, outer race should turn only counterclockwise, Fig. 7-185).

12. Install sprag bushing, cup side down, over sprag assembly.

13. Install sprag retainer and snap ring.

d. Install Front Band and Direct Clutch Assembly

1. Inspect front band for cracks or distortion and band ends for damage at anchor lug and apply lug. Also inspect lining for cracks, flaking, burning, and looseness.

2. Install front band with band anchor hole over band anchor pin, and apply lug facing servo hole, Fig. 7-186.

3. Install direct clutch housing and intermediate sprag assembly. Make certain that clutch housing hub bottoms on sun gear shaft and splines on forward end of sun gear shaft are flush with splines in direct clutch housing.

(NOTE: It will be necessary to rotate clutch housing to allow sprag outer race to index with inter-

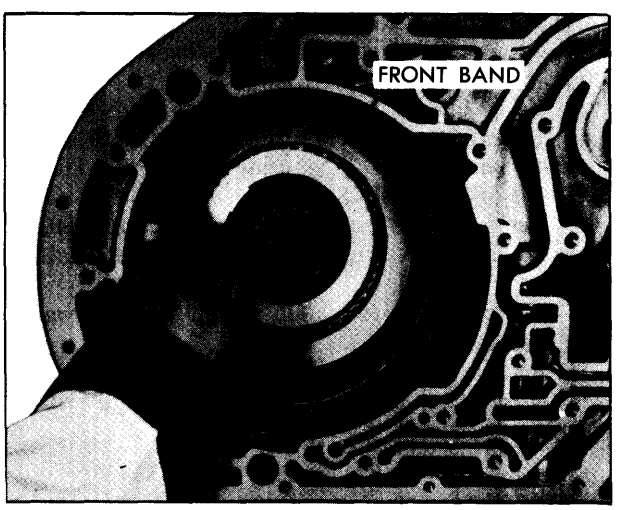


Fig. 7-186 Installing Front Band

BACK TO INDEX

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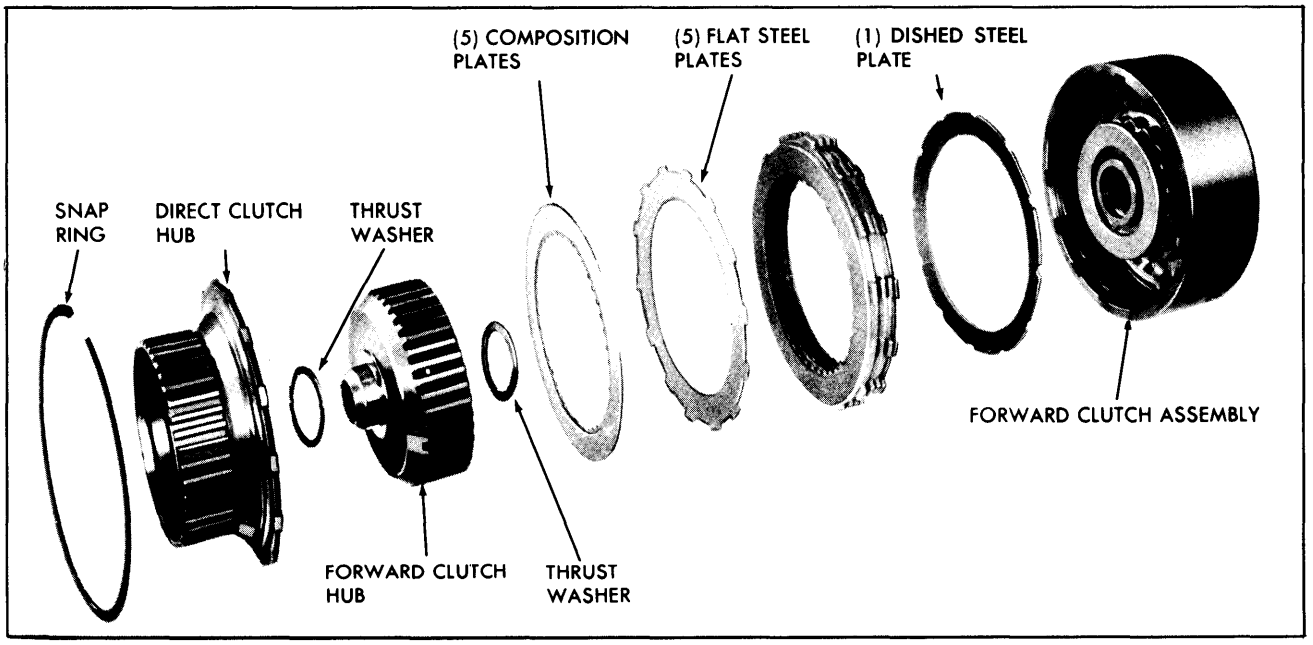


Fig. 7-187 Forward Clutch Assembly—Disassembled View

mediate composition clutch plates. Removal of direct clutch composition-faced and steel plates may be helpful, and applying air pressure through the center support screw to apply the intermediate clutch plates may facilitate assembly.)

4. Check operation of direct clutch by applying air pressure through direct clutch passage next to center support bolt, Fig. 7-71.

89. Forward Clutch Assembly

a. Disassembly (Fig. 7-187)

1. Remove forward clutch housing to direct clutch hub snap ring.
2. Remove direct clutch hub.
3. Remove forward clutch hub and one thrust washer from inner side of hub.
4. Remove five composition and five flat and one dished steel clutch plates.
5. Using Clutch Spring Compressor, J-4670, and Adapter, J-21664, compress spring retainer with arbor press and remove snap ring using Snap Ring Pliers, J-8059 or J-5586, Fig. 7-188.
6. Remove tools, spring retainer and 16 clutch release springs. Keep springs separate from direct clutch springs.
7. Remove forward clutch piston from forward clutch housing.
8. Remove inner and outer seals from clutch piston.
9. Remove center piston seal from forward clutch housing.

b. Inspection

1. Inspect composition-faced and steel clutch plates for signs of burning, scoring or wear.
2. Inspect sixteen release springs for collapsed coils or signs of distortion.
3. Inspect clutch hubs for worn splines, proper lubrication holes, and thrust faces.
4. Inspect piston for cracks.
5. Inspect clutch housing
5. Inspect clutch housing for wear, scoring, cracks and open oil passages, also check for free operation of check ball.

c. Assembly (Fig. 7-189)

1. Lubricate new inner and outer clutch piston seals with transmission fluid. Lubricate seal grooves in forward clutch piston with petrolatum and install seals with lips facing away from spring pockets.
2. Lubricate new center piston seal with transmission fluid. Lubricate seal groove in forward clutch housing with petrolatum and install seal into clutch housing with lip facing up.

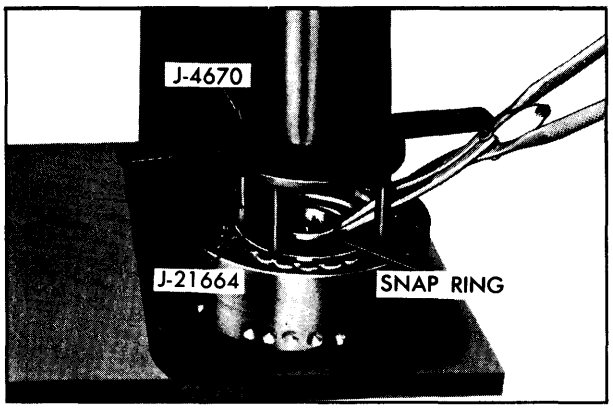


Fig. 7-188 Installing Forward Clutch Snap Ring

BACK TO INDEX
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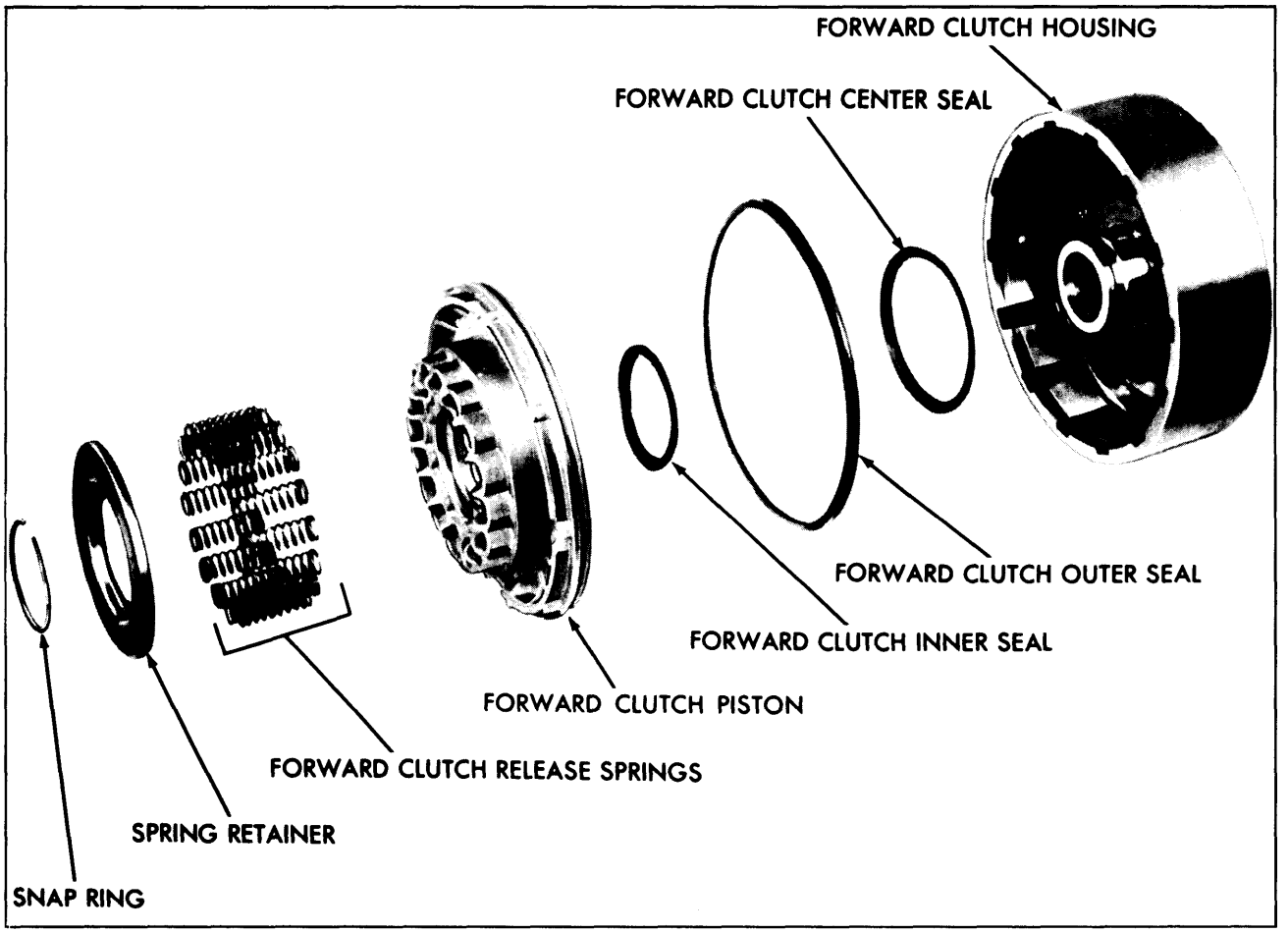


Fig. 7-189 Forward Clutch—Disassembled View

3. Place forward and Direct Clutch Inner Seal Protector, J-21362, over forward clutch hub. Install clutch piston inside Forward and Direct Clutch Piston Installer, J-21409, insert assembly in forward clutch housing, Fig. 7-189 and install clutch piston by rotating it slightly in a clockwise direction until seated, Fig. 7-190.

4. Install sixteen clutch release springs into spring pockets in clutch piston.

5. Using Clutch Spring Compressor, J-4670, and Adapter, J-21664, compress spring retainer with arbor press, being careful that retainer does not catch in snap ring groove, and install snap ring using Snap Ring Pliers, J-8059 or J-5586, Fig. 7-188 and remove tools.

CAUTION: Make certain clutch release springs are not leaning. If necessary, straighten with a small screwdriver.

6. Remove forward clutch assembly from arbor press and place on work bench.

7. Install the forward clutch hub thrust washers on the forward clutch hub making sure bronze washer is installed on side of hub facing forward clutch housing. Retain with petrolatum.

8. Install forward clutch hub in forward clutch housing.

9. Lubricate the dished and five flat steel and five composition clutch plates with transmission fluid and

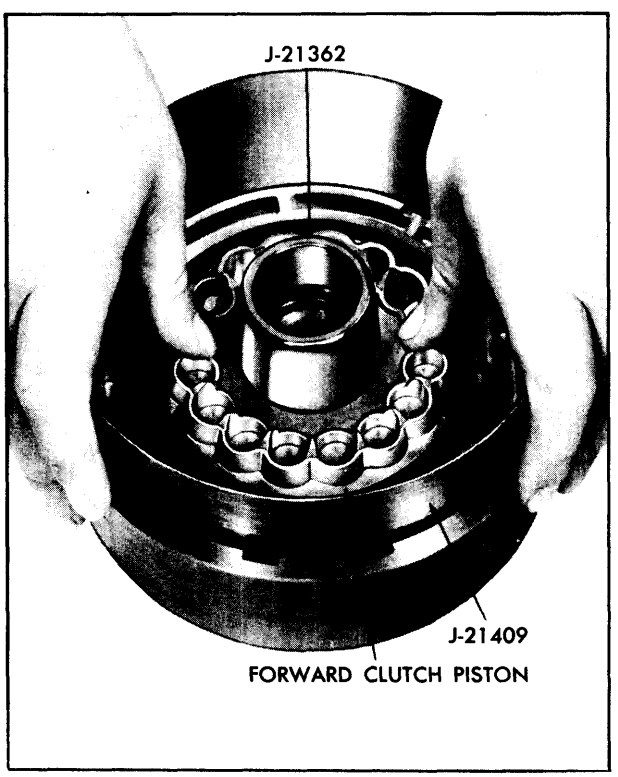


Fig. 7-190 Installing Forward Clutch Piston

BACK TO INDEX

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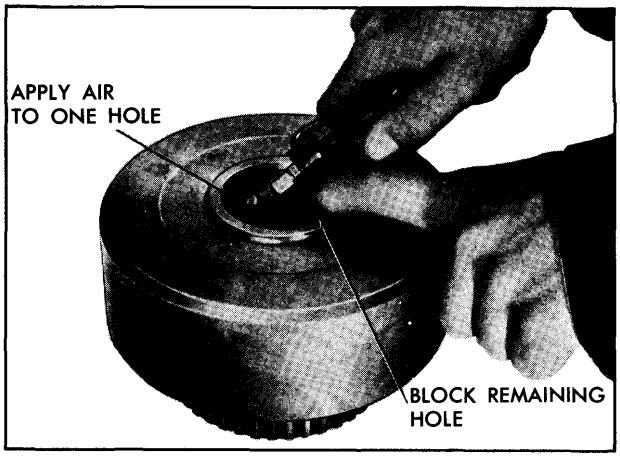


Fig. 7-191 Air Checking Forward Clutch

install clutch plates in forward clutch housing. Start with dished steel plate (O.D. up) and place a flat steel plate on top of the dished steel plate. Then alternate composition faced and flat steel clutch plates.

10. Install direct clutch hub in forward clutch housing over clutch plates, and install snap ring.

11. Air check forward clutch and piston operation, Fig. 7-191.

d. Install Forward Clutch

1. Install Front Unit End Play Checking Tool, J-22241 into forward clutch, Fig. 7-143.

2. Install forward clutch assembly into transmission, making certain main shaft goes into forward clutch hub. It will be necessary to rotate clutch housing to allow direct clutch driving hub to index with direct clutch composition-faced plates.

3. Remove Front Unit End Play Checking Tool, J-22241.

90. Install Pump Cover Plate

1. Install new pump cover plate gasket on transmission.

2. Install pump cover plate on transmission and install attaching bolts per bolt chart, Fig. 7-192.

(NOTE: Do not install pump attaching bolts (F) or single bolt (E) in pump cover plate at this time.)

3. Using the driven sprocket as a driver rotate the forward clutch.

(NOTE: If the forward clutch housing cannot be rotated as the pump cover plate is being pulled into place, the forward or direct clutch housings have not

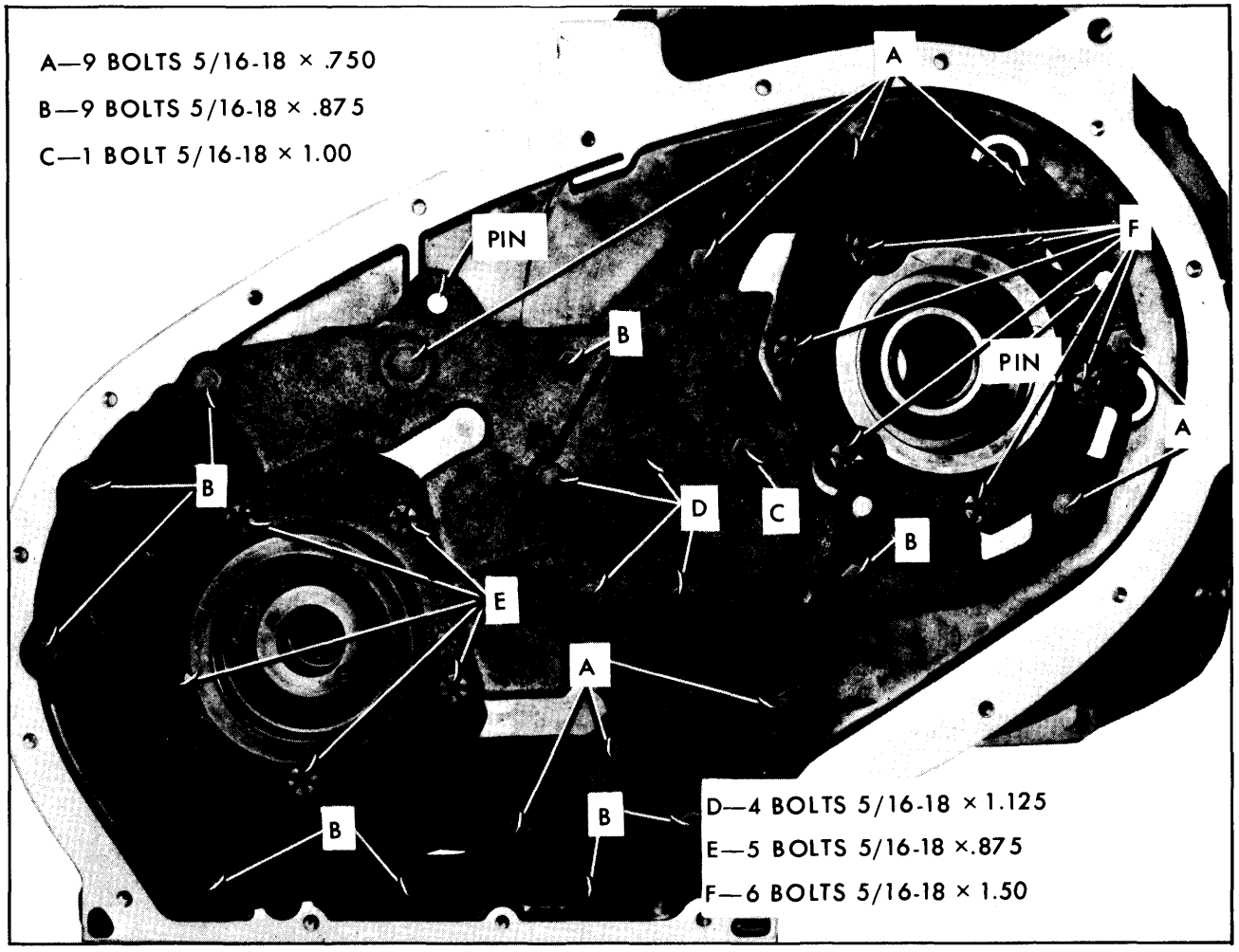


Fig. 7-192 Pump Cover Plate Screws

BACK TO INDEX

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been properly installed to index with all the clutch plates. This condition must be corrected before the pump cover plate is pulled fully into place.)

4. Torque all bolts to 20 foot-pounds.
5. Repeat front unit end play check as described in Note 80.
6. Install remaining bolt (E) in driven support housing, tightening to 20 foot-pounds.

91. Oil Pump

a. Disassembly

1. Mark drive and driven gears for reassembly in same position and remove the pump body.

(NOTE: Installing the gears in the same position as removed will assure the quietest operation, as the gear teeth will mesh in the established wear pattern.)

2. Remove drive and driven gears from pump body.
3. Remove and discard pump body to case square-cut O-ring seal.

b. Inspection

1. Using tip of finger, inspect gear pocket and crescent for nicks, burrs, scoring or galling.
2. Inspect drive gear for nicks, burrs, scoring, or galling.
3. Inspect driven gear for nicks, burrs, scoring, or galling.
4. Place pump gears in pump body and check pump body face to gear face clearance. Clearance should be .0013" - .0035".
5. Check face of pump body for nicks, burrs, scoring, or galling.
6. Check pump body face flatness. Overall flatness should be .000" to .002".
7. Inspect bushing for nicks, burrs, scoring, galling, out-of-round, or excessive wear.

(NOTE: To check for out-of-round, install pump body on the converter hub and look for eccentricity between pump bushing and converter hub.)

8. Check for damaged pump cover plate bolt holes.
9. Inspect front seal for damage. If replacement of front seal is necessary, use a standard 3/4" cold chisel and pry front seal pump body, Fig. 7-193.

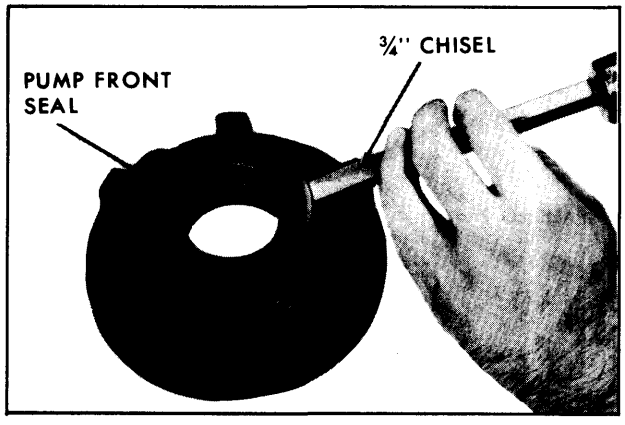


Fig. 7-193 Removing Pump Front Seal

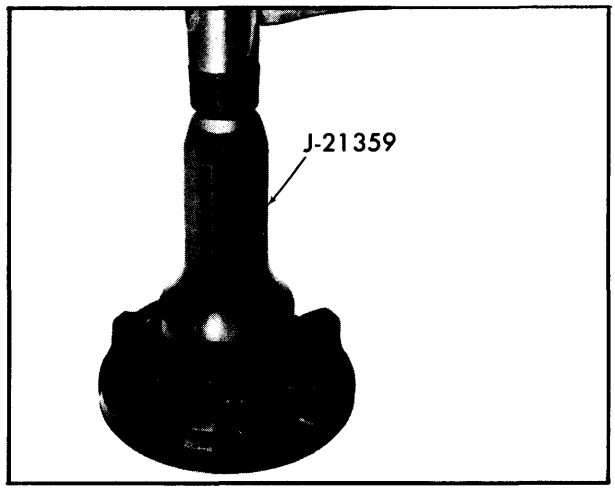


Fig. 7-194 Installing Pump Front Seal

c. Assembly

1. If necessary, install a new front seal, using Pump Oil Seal Installer, J-21359, to drive seal into place. Use a non-hardening sealer on outside of seal before installing into pump, Fig. 7-194.
2. Install new pump to case square-cut O-ring seal, Fig. 7-195.
3. Install driven gear into pump body with alignment mark up.
4. Install drive gear into pump body with drive tangs up, Fig. 7-196.

(NOTE: Drive gear should always be installed with counterbore down.)

d. Installation

1. Rotate transmission in holding fixture base so that cored oil passages are up.
2. Install pump assembly over stator shaft and position to drive support housing, rotating pump as necessary to align holes in pump cover plate with pump attaching bolt holes.
3. Install six retaining bolts (F), finger tight, Fig. 7-192.
4. Rotate transmission in holding fixture base so that pump cover plate is up.
5. Tighten pump attaching bolts to 20 ft. lbs.

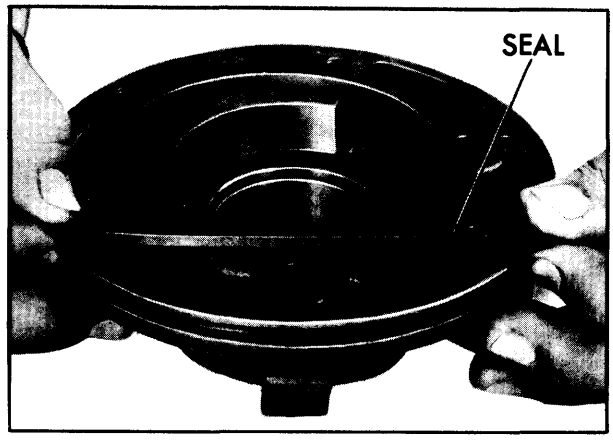


Fig. 7-195 Installing Pump-to-Case Seal

BACK TO INDEX

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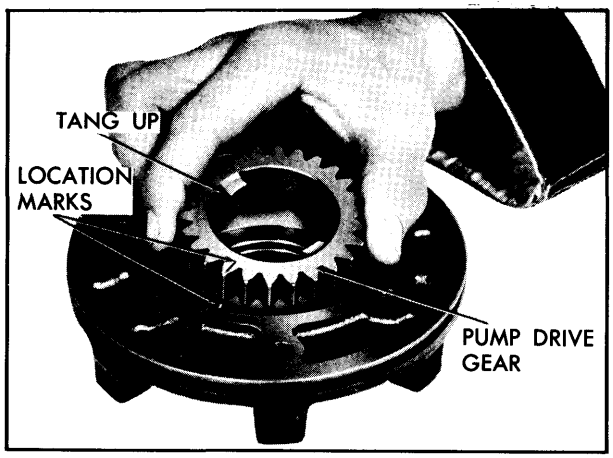


Fig. 7-196 Installing Pump Drive Gear

92. Install Sprockets, Link Assembly and Sprocket Cover

1. Rotate transmission in holding fixture base so that cored oil passages are up.
2. Position drive and driven sprockets on workbench with shafts up, and drive sprocket closest to transmission.
3. Install link assembly over drive and driven sprockets with colored guide link, which has etched numerals, down.
4. Lift sprockets and link assembly and rotate assemblies 90° so that drive sprocket is up.
5. Allowing driven sprocket to hang down freely, start turbine shaft into pump support housing until it will support weight of assembly.
6. Start input shaft into driven support housing, and alternately push shafts inward until sprockets are installed.
7. Rotate transmission in holding fixture base so that sprockets are up.

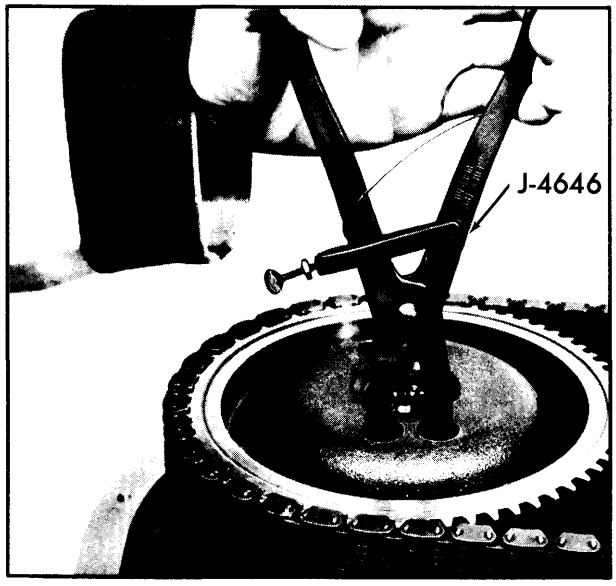


Fig. 7-197 Installing Sprocket Snap Ring

8. Using a plastic mallet, gently tap sprockets to seat sprocket bearing assemblies into support housing.
9. Install Snap Ring Pliers, J-4646, into sprocket bearing retainer snap rings, located under the drive and driven sprockets, and install snap rings into retaining grooves on support housings, Fig. 7-197.
10. Install new sprocket cover to case gasket on transmission case.
11. Position sprocket cover to transmission case and install 18 attaching bolts, tightening bolts to 8 ft. lbs.

(NOTE: One sprocket cover attaching bolt is 1/4 inch longer. This bolt must be installed in the tapped hole directly over the cooler fittings on the transmission case.)

93. Detent Lever, Manual Shaft, Parking Linkage, Rear Servo, Front Servo, Check Balls, and Control Valve Spacer

a. Inspect Detent Lever, Manual Shaft, and Parking Linkage

1. Inspect parking actuator rod for cracks, or broken spring retainer lugs.
2. Inspect actuator spring for damage.
3. Inspect actuator for a free fit on actuator rod.
4. Inspect parking pawl for cracks or wear.
5. Inspect manual shaft for damaged threads.
6. Inspect inside detent lever for cracks or a loose pin.
7. Inspect parking pawl return spring for deformed coils or ends.
8. Inspect parking bracket for cracks or wear.
9. Inspect detent spring and roller assembly.

b. Install Detent Lever, Manual Shaft and Parking Linkage

1. Install parking pawl (tooth toward inside of case), pawl return spring and parking pawl shaft into case, Fig. 7-198.
2. Install parking pawl shaft retaining pin into case hole.
3. Install parking bracket into case, tightening attaching screws to 18 ft. lbs.

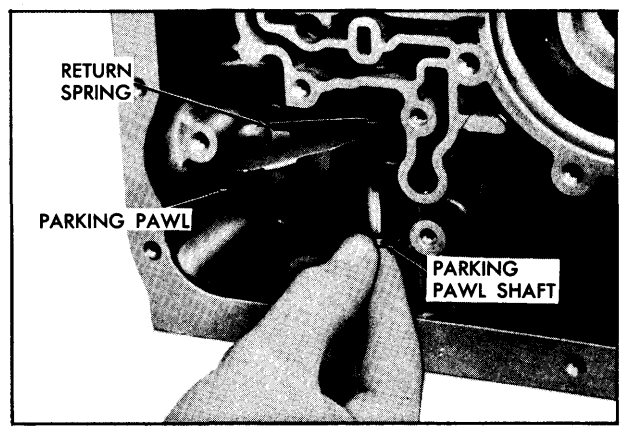


Fig. 7-198 Installing Parking Pawl

BACK TO INDEX

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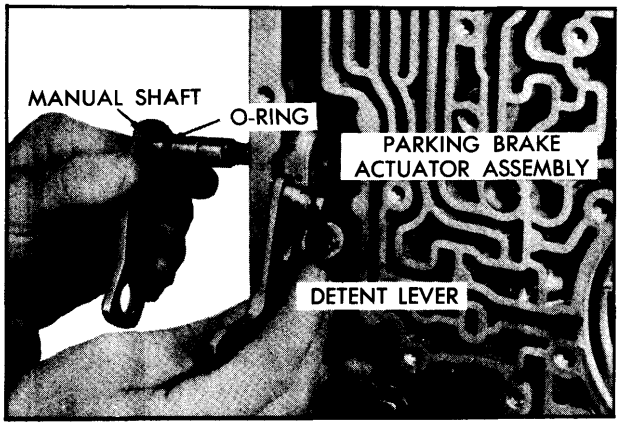


Fig. 7-199 Installing Manual Shaft

4. Install a new manual shaft O-ring seal on manual shaft.
5. Install the actuator rod plunger under the parking bracket and over the parking pawl and through hole in detent lever. Position detent lever in transmission case.
6. Install the manual shaft assembly through the retaining lock nut on manual shaft, Fig. 7-199.
7. Install manual shaft retaining pin into case, long smooth end first.
8. Torque lock nut to 18 ft. lbs.

c. Disassemble Rear Servo Assembly (Fig. 7-200)

1. Remove rear accumulator piston from rear servo piston.
2. Remove E-ring retaining rear servo piston to band apply pin.
3. Remove rear servo piston and seal from band apply pin.
4. Remove washer, spring and retainer.

d. Inspect Rear Servo

1. Check freeness of oil seal rings in accumulator piston grooves.

(NOTE: See Fig. 7-200. Do not remove the oil seal rings from the rear accumulator piston, unless the oil seal rings require replacement.

If the teflon inner oil seal ring, (small diameter) requires replacement, for service, use the aluminum oil seal ring.

The rear accumulator piston, large diameter ring groove depth, is machined shallower to take the large teflon oil seal ring; if this requires replacement, use only the teflon oil seal ring.)

2. Inspect fit of band apply pin in servo piston.
3. Inspect band apply pin for scores or cracks.
4. Inspect band apply pin for proper size as determined by pin selection check (Note 74.)

e. Assemble Rear Servo

1. Install spring retainer, cup side first, servo pin spring and washer on servo pin.
2. Install servo piston on pin and secure with E-ring retainer.
3. If removed, install oil seal ring on servo piston.
4. If removed, install inner and outer oil rings on accumulator piston.
5. Install accumulator iston nto bore of servo piston.

f. Install Rear Servo

(NOTE: If transmission is in the vehicle, a sheet metal bracket will be required to hold the rear servo assembly, front servo assembly, check balls, valve body

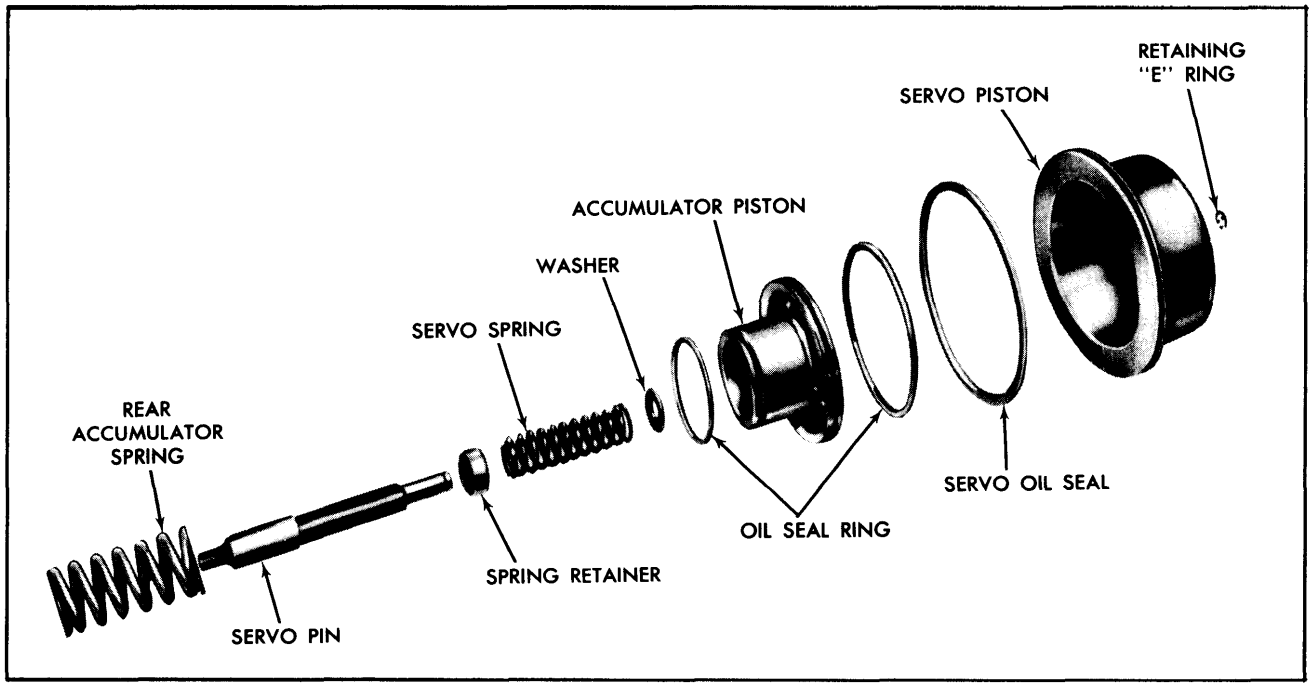


Fig. 7-200 Rear Servo and Accumulator—Disassembled View

BACK TO INDEX

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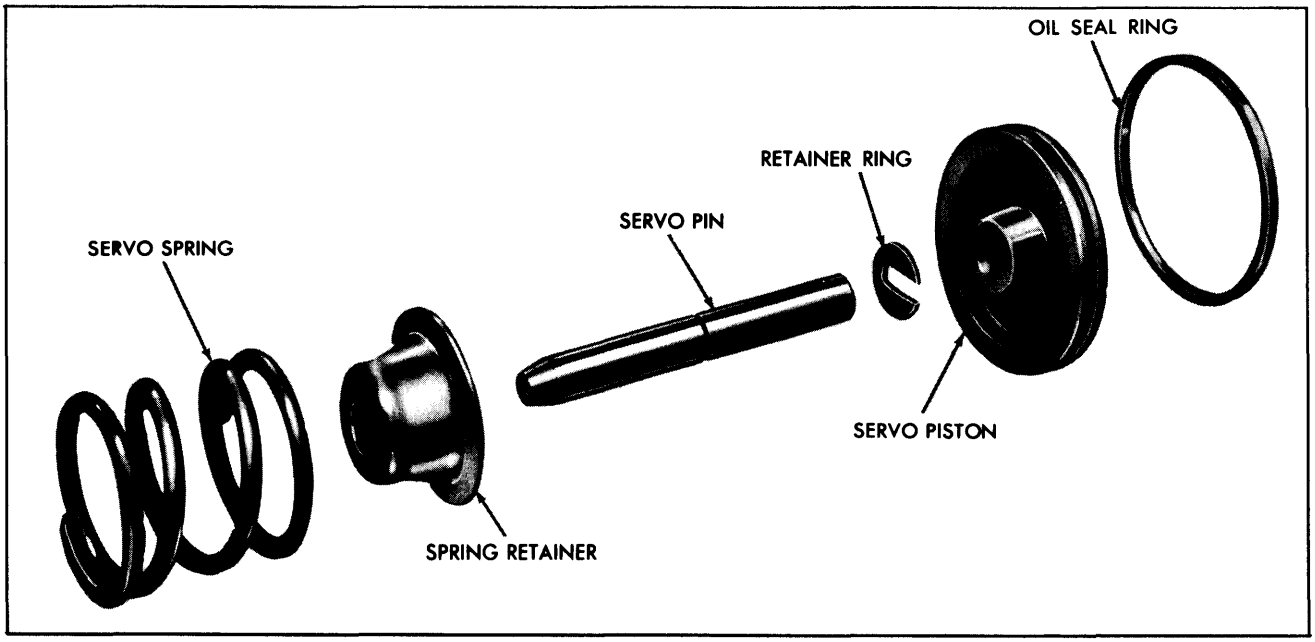


Fig. 7-201 Front Servo—Disassembled View

to spacer plate gasket and valve body spacer plate, until the control valve assembly is installed. See Fig. 7-208.)

1. Lubricate inner and outer rear servo bores in transmission case with transmission fluid and install rear accumulator spring in servo inner bore.

(NOTE: Before installing rear servo assembly, make certain that rear band apply lug is aligned with servo pin bore in transmission case. Otherwise servo pin will not apply band.)

2. Position rear servo assembly in transmission case bore.
3. Press down on rear servo assembly, making certain oil seal ring is properly seated in case bore.

g. Inspect Front Servo

NOTE: See Fig. 7-201. Do not remove the oil seal ring from the front servo piston unless the oil seal ring requires replacement. For service, the oil seal ring will be aluminum.)

CAUTION: The spring retainer, servo pin, retaining ring and servo piston for 1971 thru 1975 are not interchangeable with the pre-1971 parts.

1. Inspect servo pin for damage.
2. Inspect piston oil ring for damage.
3. Inspect piston for cracks or porosity.
4. Check fit of servo pin in piston and case.

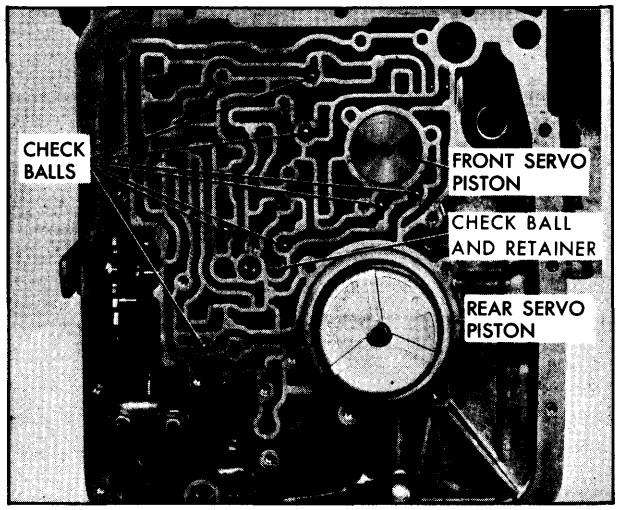


Fig. 7-202 Location of Check Balls

h. Install Front Servo Assembly

Reassemble parts of front servo, Fig. 7-201, making sure tapered end of servo pin is pointed through the spring and spring retainer, and install in bore in case. Make sure the retainer ring is installed in the servo pin groove.

(NOTE: The teflon ring allows the front servo piston to slide very freely in the case. The free fit of the ring in the bore is a normal characteristic and does not indicate leakage during operation. The teflon ring should only be replaced if it shows damage or if evidence of leaking during operation exists.)

i. Install Check Balls and Control Valve Spacer

1. Install seven check balls in cored passages, Fig. 7-202.)

(NOTE: If transmission is in vehicle, place check balls into ball seat pockets on spacer plate.)

2. Install valve body spacer to case gasket on transmission case.
3. Install valve body spacer on transmission.

(NOTE: Valve body spacer to case gasket should extend approximately 1/8 inch beyond the spacer plate, at the void case channel, Fig. 7-203. If service gaskets are being installed, the valve body spacer to case gasket has an extension which will cover the void case channel.)

BACK TO INDEX

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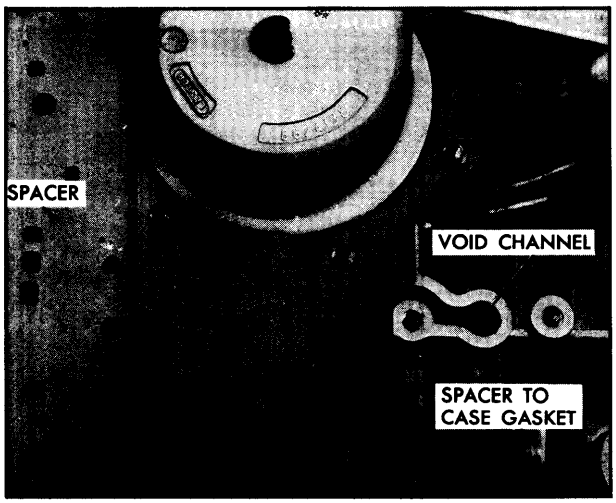


Fig. 7-203 Valve Body Spacer-to-Case Gasket

4. Install valve body to spacer gasket.
5. Install guide pins.

94. Control Valve Assembly (Fig. 7-211)

a. Disassembly

When disassembling control valve, make certain that springs are accurately identified so that they can be properly reassembled.

1. Position control valve assembly with gasket surface down.
2. Remove two screws securing detent solenoid to control valve body and remove detent solenoid and gasket.
3. Position control valve assembly with gasket surface up and accumulator pocket on bottom.
4. Remove manual valve from upper bore.
5. Install Control Valve Accumulator Piston Installer, J-21885 or J-22269-01, on accumulator piston, compress piston and remove E-ring retainer, Fig. 7-205.
6. Remove Installer, J-21885 or J-22269-01, and remove accumulator piston and spring.

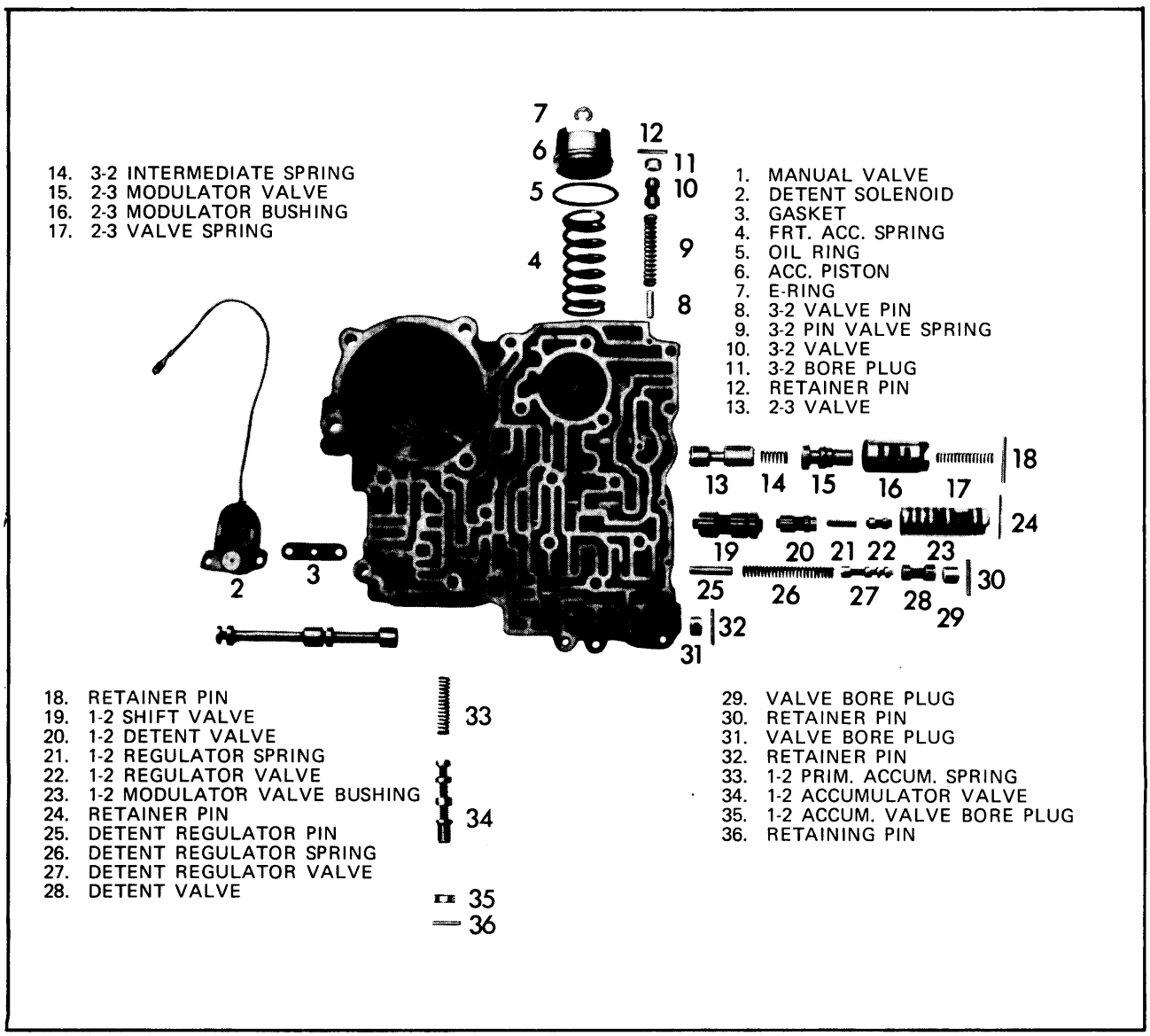


Fig. 7-204 Control Valve—Disassembled View

BACK TO INDEX

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7. Using pin punch, remove retaining pin from lower left bore, pressing on pin from outer side of valve body. Remove 2-3 modulator bushing, 2-3 shift valve spring, 2-3 modulator valve, 3-2 intermediate spring and 2-3 shift valve from lower left bore.

(NOTE: 2-3 modulator valve will be inside of 2-3 modulator bushing.)

8. Using pin punch, remove retaining pin from lower center left bore, pressing on pin from outer side of valve body. Remove 1-2 modulator bushing, 1-2 regulator valve and spring, 1-2 detent valve and 1-2 shift valve from lower left center bore.

9. Using pin punch, remove retainer pin from upper left center bore by pressing on outer side of valve body.

WARNING: HOLD HAND OVER BORE WHEN REMOVING RETAINER PIN AS DETENT REGULATOR VALVE SPRING MAY FORCE OTHER COMPONENTS OUT OF BORE.

10. Remove bore plug, detent valve, detent regulator valve, spacer and detent regulator valve spring from upper left center bore.

11. Remove retaining pin from bottom bore on left side by prying out with a pair of long nose pliers.

WARNING: HOLD HAND OVER BORE WHEN REMOVING RETAINER PIN AS 3-2 VALVE SPRING MAY FORCE BORE PLUG OUT.

12. Remove bore plug, 3-2 valve, spring and spacer from bottom left bore.

13. Remove retaining pin from top bore by prying out with long nose pliers from outer side of valve body.

WARNING: HOLD HAND OVER BORE WHEN REMOVING RETAINER PIN AS ACCUMULATOR SPRINGS MAY FORCE OTHER COMPONENTS OUT OF BORE.

14. Remove bore plug, 1-2 accumulator valve and 1-2 accumulator primary spring.

b. Inspection

(NOTE: See Fig. 7-201. Do not remove the oil seal ring from the front accumulator piston unless the oil seal ring requires replacement. For service, the oil seal ring will be aluminum.)

CAUTION: The front accumulator piston for 1971 thru 1975 transmissions is not interchangeable with the pre-1971 parts.

1. Wash control valve body, valves, and other parts in clean solvent.

CAUTION: Do not allow valves to bump together, as this might cause nicks and burrs.

2. Inspect all valves and bushings carefully to make sure that they are free from dirt and are not damaged in any respect. If burrs are present, they should be removed with a fine stone or fine grade of crocus cloth and light oil. Be careful not to round off shoulders of valves.

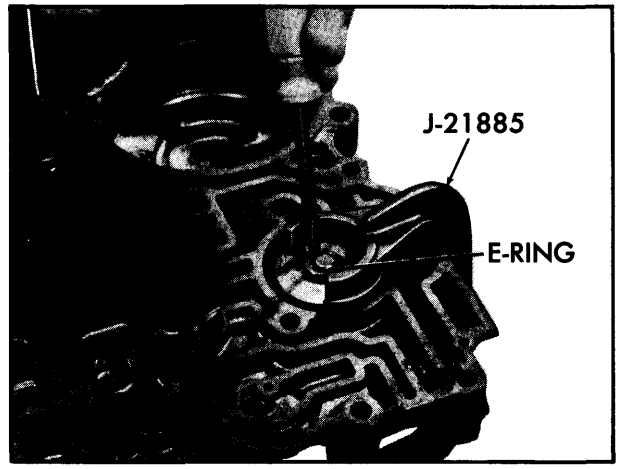


Fig. 7-205 Removing Front Accumulator

3. All valves and bushings should be tested in their individual bores to make certain that free movement can be obtained. All valves should fall freely of their own weight with a slight tapping action on the body. In checking be careful to prevent valve damage in any way.

4. The manual valve is the only valve that can be serviced separately. If other valves are damaged beyond repair, a new control valve assembly should be installed.

5. Inspect body for cracks or scored bores.

6. Check all springs for distortion or collapsed coils.

7. Inspect piston and oil ring for damage.

c. Assembly (Fig. 7-204)

1. Position control valve body with gasket surface up and accumulator pocket on bottom.

2. Install the 1-2 primary accumulator spring into top bore.

3. Install the 1-2 accumulator valve, stem end out into top bore.

4. Install the 1-2 bore plug into top bore.

5. Install grooved retaining pin, grooved end entering hole last from outer side of valve body, pressing pin flush with valve body.

6. Insert spacer inside of 3-2 valve spring and install spring and spacer in bottom left bore.

7. Install 3-2 valve in bottom left bore.

8. Compressing 3-2 valve spring, install bore plug, hole end out, and secure with grooved retaining pin from cored side of valve body.

9. Insert spacer inside of detent regulator valve spring and install spring and spacer into upper left center bore, making certain spring seats in bottom of bore.

10. Compress detent regulator valve spring and hold with a small screwdriver placed between end of spring and wall on cored side of valve body.

11. Install detent regulator valve, stem end out, and detent valve, small land first, into upper left center bore.

12. Insert bore plug, hole out, into upper left center bore and, pressing inward on bore plug, remove screwdriver and install remaining pin from cored side of valve body.

13. Install 1-2 shift valve, longer stem end first, in lower left center bore, making certain valve seats in bottom of bore.

BACK TO INDEX

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14. Install 1-2 regulator valve, larger stem first, spring and detent valve, hole end first, into 1-2 modulator bushing, aligning spring in bore of 1-2 detent valve.

15. Compress bushing against spring and secure with retaining pin from cored side of control valve body.

16. Install 3-2 intermediate spring in open end of 2-3 shift valve and install valve and spring, valve first, into lower left bore. Make certain valve seats in bottom of bore.

17. Install 2-3 modulator valve, hole end first, into 2-3 modulator bushing and install both parts in lower left bore.

18. Install 2-3 shift valve spring into hole in 2-3 modulator valve, and compressing spring, secure with retaining pin from cored side of control valve.

19. Position front accumulator spring and piston into valve body and install Control Valve Accumulator Piston Installer, J-21885 or J-22269-01 on piston. Compress spring and piston, aligning spring and piston with bore, Fig. 7-205.

CAUTION: Make certain that piston pin is correctly aligned with hole in piston and that oil seal ring does not catch on lip of bore when installing piston.

20. Secure piston and spring with E-ring retainer and remove Installer, J-21885 or J-22269-01.

21. Install manual valve into top bore.

22. Placing control valve assembly on gasket surface, position detent solenoid gasket and detent solenoid on valve body.

23. Install downshift solenoid attaching screws.

24. Install governor drive pipe into control valve body in bore by rear servo cover.

25. Install two governor screen assemblies with open end up, Fig. 7-206.

d. Install Control Valve Assembly (Fig. 7-208)

1. Using two guide pins, Fig. 7-207, install control valve assembly and governor pipe on transmission. Make certain gaskets and spacer do not become mispositioned.

(NOTE: Check manual valve to make sure it is indexed properly with pin on detent lever and governor pipe to make certain it is properly seated in case hole.)

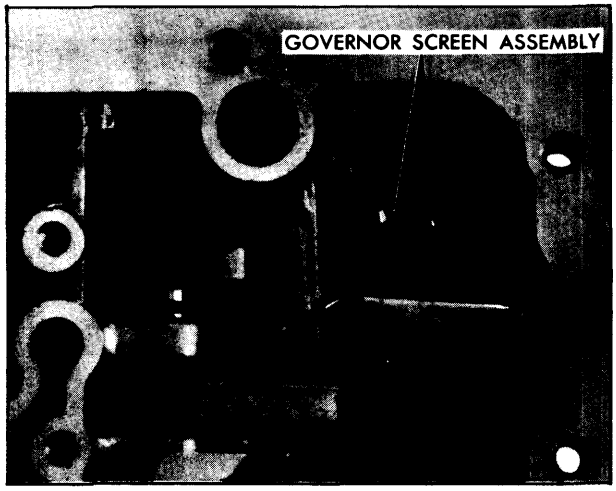


Fig. 7-206 Installing Governor Screens

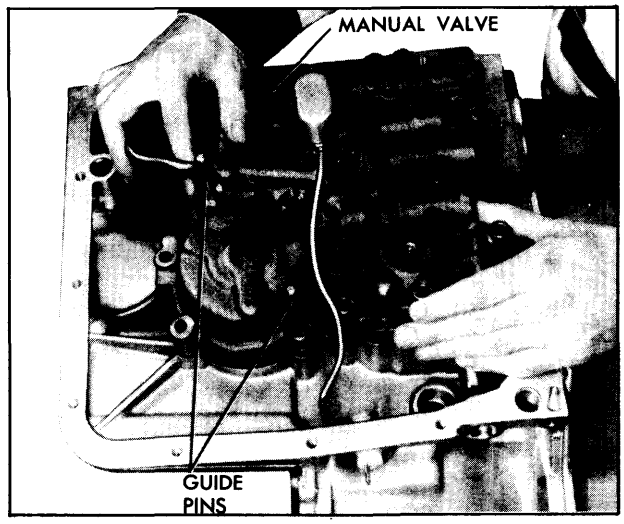


Fig. 7-207 Installing Control Valve Assembly

2. Remove guide pins and install control valve assembly attaching screws, eliminating detent roller and spring assembly attaching screw. Torque bolts to 8 foot-pounds, Fig. 7-209.

3. Install detent roller and spring assembly and attaching screw. Tighten screw to 8 foot-pounds.

4. Install detent solenoid wire to electrical connector.

5. Install governor feed pipe in transmission case and control valve body.

(NOTE: Make certain that governor feed pipe is seated in bores in case and valve body.)

95. Pressure Regulator Valve, Intake Pipe and Filter Assembly, Bottom Pan, Modulator Valve and Modulator

a. Install Pressure Regulator Valve

1. Install spring retainer on pressure regulator

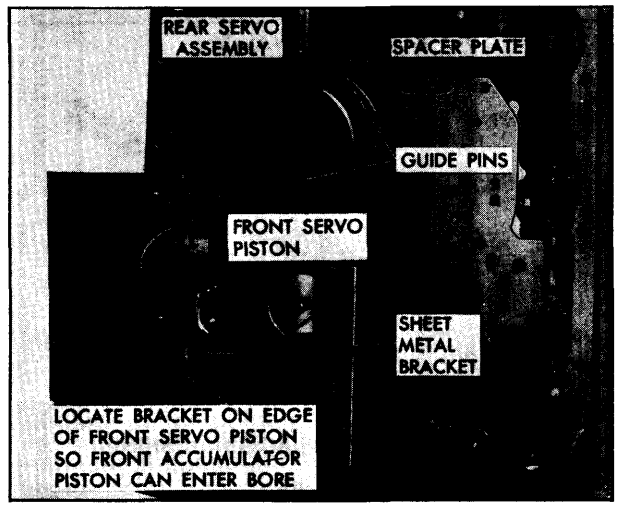


Fig. 7-208 Installing Control Valve Assembly—(on Car)

BACK TO INDEX

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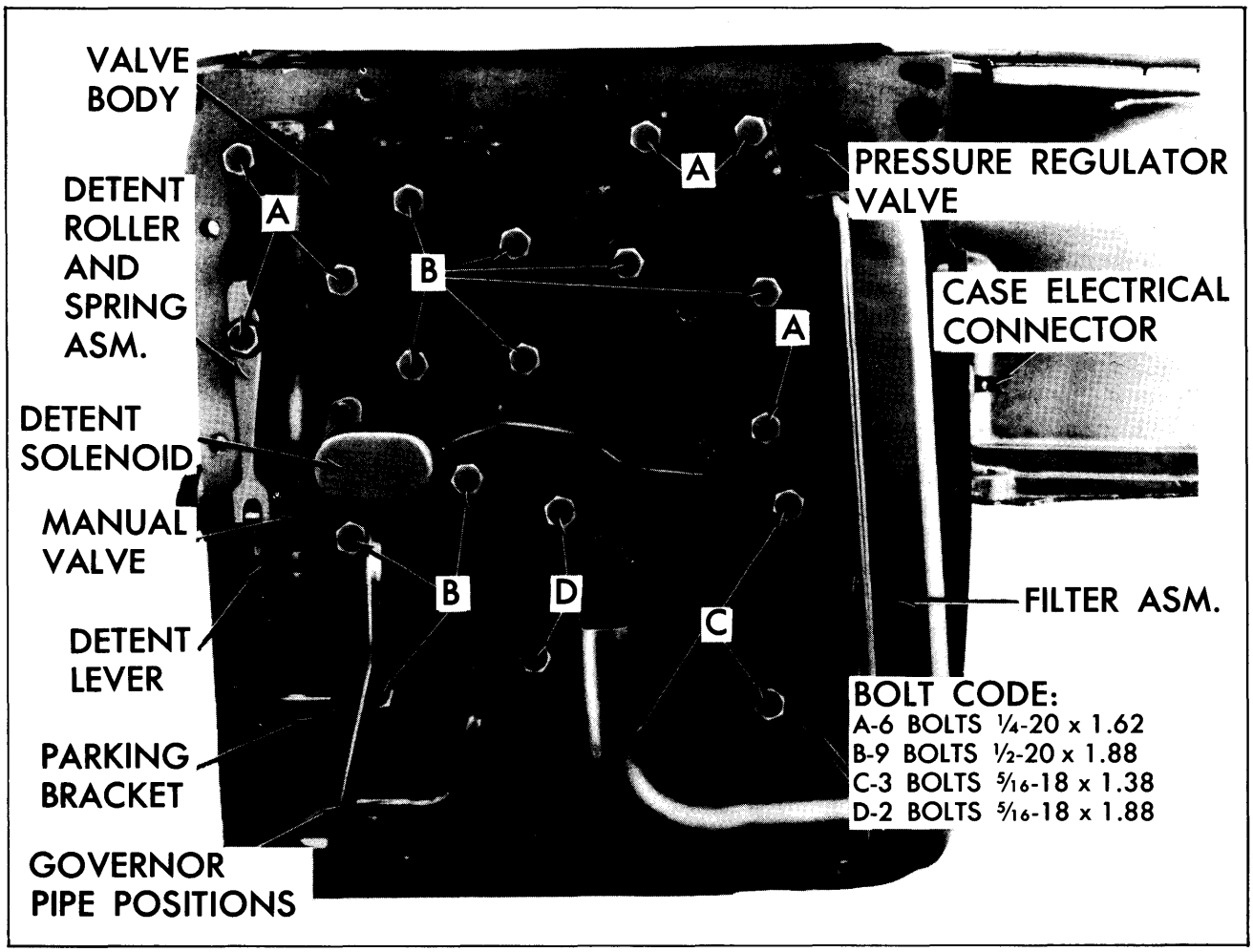


Fig. 7-209 Control Valve Assembly Screws

spring. Also install spacers if previously removed, Fig. 7-210.

2. Install pressure regulator valve on spring, stem end first.

3. Install boost valve into bushing, stem end out, and stack parts so that pressure regulator spring is against valve bushing.

4. Install complete assembly, pressure regulator valve first, into pressure regulator valve bore, being careful not to drop parts during installation.

5. Using a screwdriver or steel rod, compress regulator boost valve bushing against pressure regulator spring until it is beyond snap ring groove, and install snap ring using Snap Ring Pliers, J-5403 (#21), Fig. 7-211.

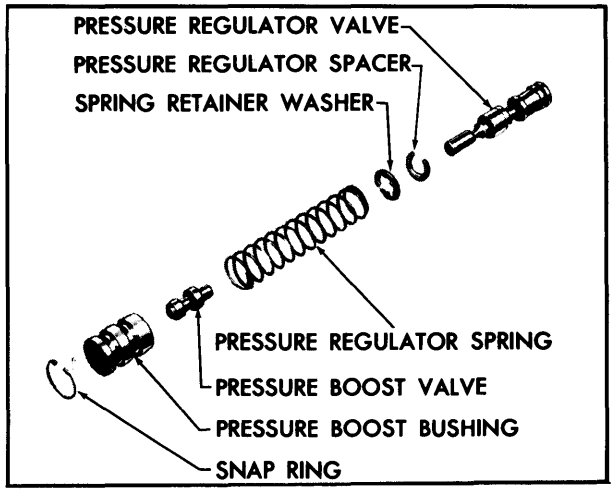


Fig. 7-210 Pressure Regulator Valve—Disassembled View

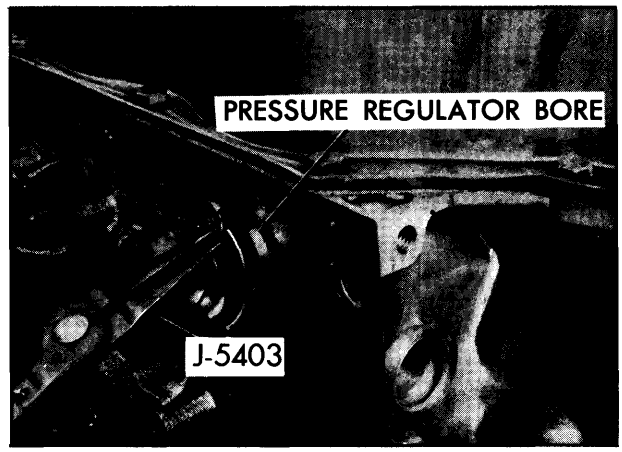


Fig. 7-211 Installing Pressure Regulator Valve

BACK TO INDEX

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(NOTE: To facilitate installation of snap ring, encircle it around screwdriver or steel rod, compress tangs with snap ring pliers, and slide snap ring into ring groove in valve bore.)

b. Install Intake Pipe and Filter Assembly and Bottom Pan

1. Install new intake pipe O-ring into pipe bore in transmission case and install intake pipe and filter assembly.
2. Install new bottom pan gasket on transmission case and install bottom pan.
3. Install 13 bottom pan attaching screws. Tighten screws to 12 foot-pounds.

c. Inspect Vacuum Modulator and Valve

1. Inspect vacuum modulator for any signs of bending or distortion.
2. Inspect O-ring seat for damage.
3. Inspect modulator valve for nicks or damage.
4. Check freeness of valve operation in case bore.
5. Check modulator for damaged bellows. Modulator plunger is under approximately 16 pounds pressure. If bellows is damaged, plunger will have very little pressure. Use procedure outlined in Diagnosis Part V.

d. Install Modulator Valve and Vacuum Modulator

1. Install modulator valve into case with stem end out.
2. Install new O-ring on vacuum modulator.
3. Install vacuum modulator into case with vacuum hose pipe facing case connector.
4. Install modulator retainer with curved side of tangs inboard and install attaching screw. Tighten screw to 18 foot-pounds.

96. Governor Assembly

(NOTE: All components of the governor assembly, with the exception of the driven gear, are a select fit and each assembly is factory calibrated. The governor, including the driven gear, is serviced as a complete assembly. However, the driven gear can also be serviced separately.)

a. Governor Inspection

1. Wash in cleaning solvent, and blow out all passages.
2. Inspect governor sleeve for nicks, burrs, scoring or galling.
3. Check governor sleeve for free operation in bore of transmission case.
4. Check governor valve for free operation in bore of governor sleeve.
5. Inspect governor driven gear for nicks, burrs, or damage.
6. Check governor driven gear for looseness in governor sleeve.
7. Inspect speedometer drive gear for nicks, burrs, or damage.
8. Check speedometer drive gear for looseness on governor sleeve.
9. Inspect governor springs for distortion or damage.
10. Check governor weights for free operation in their retainers.
11. Check valve opening at entry and exhaust (.020" minimum).

b. Governor Driven Gear Replacement

To facilitate governor repair in the field, governor driven gear and replacement pins are available for service use. The service package contains a nylon driven gear, two governor weight retaining pins and one governor gear retainer split pin. Replacement of gear must be performed with care in the following manner:

1. Place governor sleeve on a block of wood and drive retaining pin out, using a small punch or 1/8" drill rod.
2. Remove governor driven gear as follows:
   a. Insert governor driven gear in a vice.
   b. Firmly grip governor sleeve with hands and twisting and pulling at the same time, pull governor sleeve away from the governor driven gear.
   c. Discard governor driven gear.
3. Remove governor valve and wash all parts in cleaning solvent and blow off parts.
4. Install governor valve, end with holes last, into governor sleeve.
5. Support governor on 7/64" plates, installed in exhaust slots of sleeve, position new gear in sleeve and with a 7/16" socket, press gear into sleeve until seated. See Fig. 7-212.
6. Place governor sleeve on a block of wood and with a 1/8" drill, drill half way through each side of gear; drill through existing hole. See Fig. 7-213.
7. Install split retaining pin, making sure each end is slightly below top of hole.

CAUTION: Extreme care must be taken to prevent damaging the parts.

8. Stake both ends of pin hole, two places.
9. Thoroughly wash governor assembly in cleaning solvent and blow out all passages.

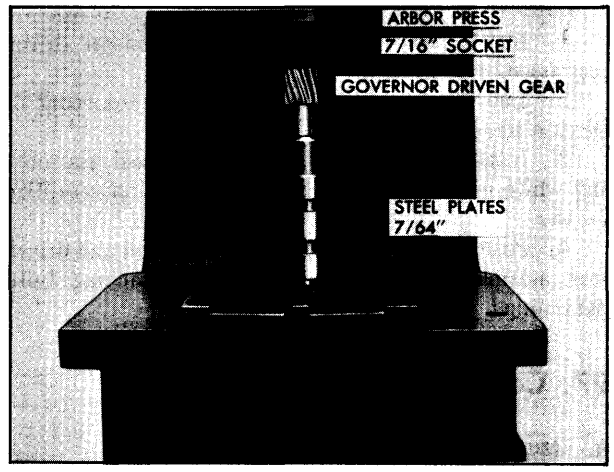


Fig. 7-212 Installing Governor Gear in Sleeve

BACK TO INDEX

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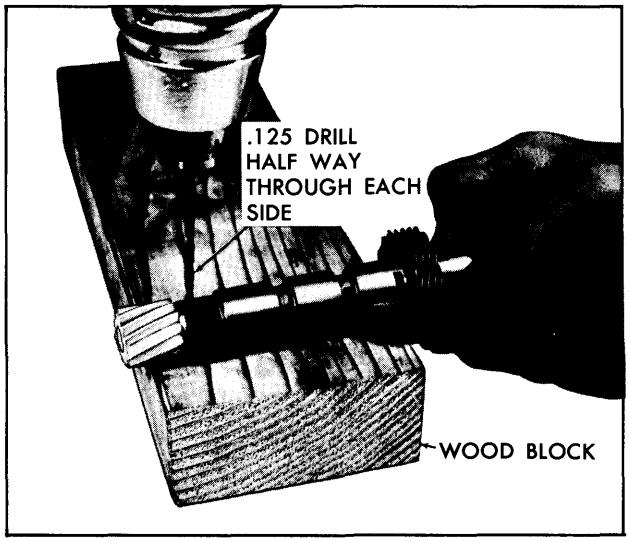


Fig. 7-213 Drilling into Side of Gear

c. Install Governor

1. Rotate transmission in Holding Fixture Base so that governor bore is up.
2. Install new square cut O-ring seal on governor assembly and install assembly into transmission case, Fig. 7-214.
3. Position retaining clip on top of governor assembly.

d. Inspect Speedometer Driven Gear Assembly

1. Inspect gear for damaged teeth or shaft.
2. Inspect sleeve for scores, damaged threads or cracks.

e. Install Speedometer Driven Gear

Rear Axle Ratio	Driven Gear Teeth	Drive Worm Gear Teeth	Color of Driven Gear
3.07:1	31	14	White
2.73:1	27	14	Black

1. Install new O-ring seal on speedometer driven gear assembly.
2. Lubricate housing lip seal with a thin coat of Dexron transmission fluid.
3. Install speedometer housing and seal assembly and white nylon driven gear into transmission case, Fig. 7-215.
4. Position retaining clip to transmission and driven gear assembly and secure with one attaching bolt, tightening bolt to 6 ft. lbs.

97. Converter

a. Inspect Torque Converter

1. Check converter for leaks as described in Note 13.

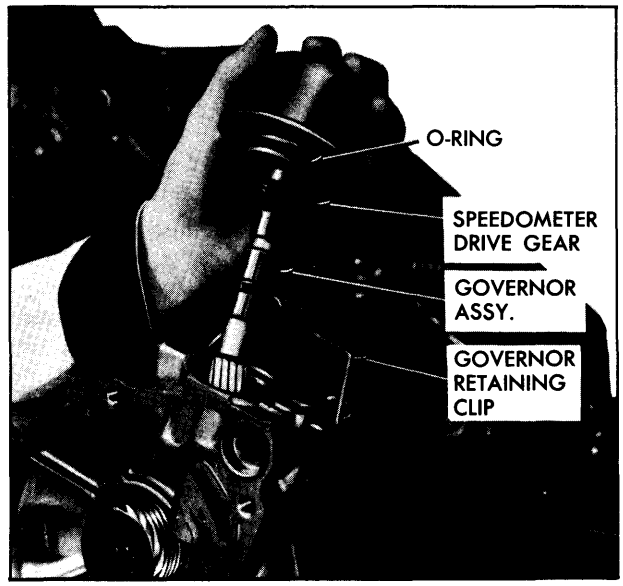


Fig. 7-214 Installing Governor Assembly

2. Check converter hub surfaces for signs of scoring or wear.

b. Install Torque Converter

1. Position transmission jack with adapter plate to transmission and install transmission on jack using brace and safety chain.
2. Carefully position converter on turbine shaft, making certain converter is properly aligned. Long screws or eyebolts can be threaded into the weld nuts on the converter and used as handles.
3. Rotate converter until the shafts are piloted and the converter lugs are indexed in the pump gear.
4. If difficulty is experienced in alignment, tap on outer diameter of converter with plastic-headed hammer, while turning converter.
5. Install Converter Holding Clamp, J-21366, on transmission case.
6. Remove Transmission Holding Fixture, J-22240, from transmission.

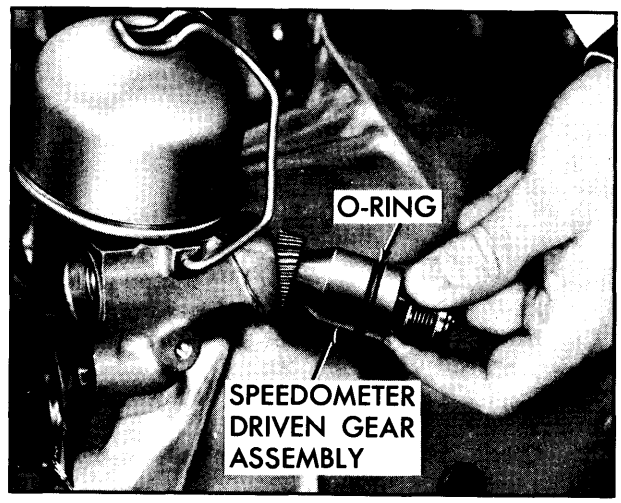


Fig. 7-215 Installing Speedometer Driven Gear

BACK TO INDEX

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TORQUE CHART

Material Number	Application	Thread Size	Foot Pounds
280M	Transmission to Engine Screws	3/8—16	35
300M	Torque Converter to Flywheel Screws	3/8—16	30
1010	Flywheel Housing Cover to Transmission Screws	1/4—20	5
300M	Final Drive to Transmission Screws	3/8—16	25
280M	Solenoid to Case Screw	1/4—20	10
Special	Line Pressure Plug	1/8 Pipe	10
260M	Vacuum Modulator Retainer	5/16—18	18
260M	Control Valve Body to Case Screw	1/4—20	8
300M	Center Support to Case	3/8—16	23
286M	Manual Shaft to Inside Lever	3/8—24	18
280M	Pump Body to Cover Plate	5/16—18	20
280M	Parking Brake Bracket to Case	5/16—18	18
1010—1020	Oil Pan to Case Screw	5/16—18	12
280M	Sprocket Housing Screw	1/4—20	8
260M	Support Housing to Cover Plate	5/16—18	20
260M	Speedometer Driven Gear Retainer to Case	5/16—18	8-12
280M	Rear Engine Mount to Transmission Bracket	3/8—16	25
280M	Support Bracket to Transmission Bolt	7/16—14	42
275M	Rear Engine Mount to Frame Screw & Washer Assembly	3/8—16	25

SPECIAL TOOLS

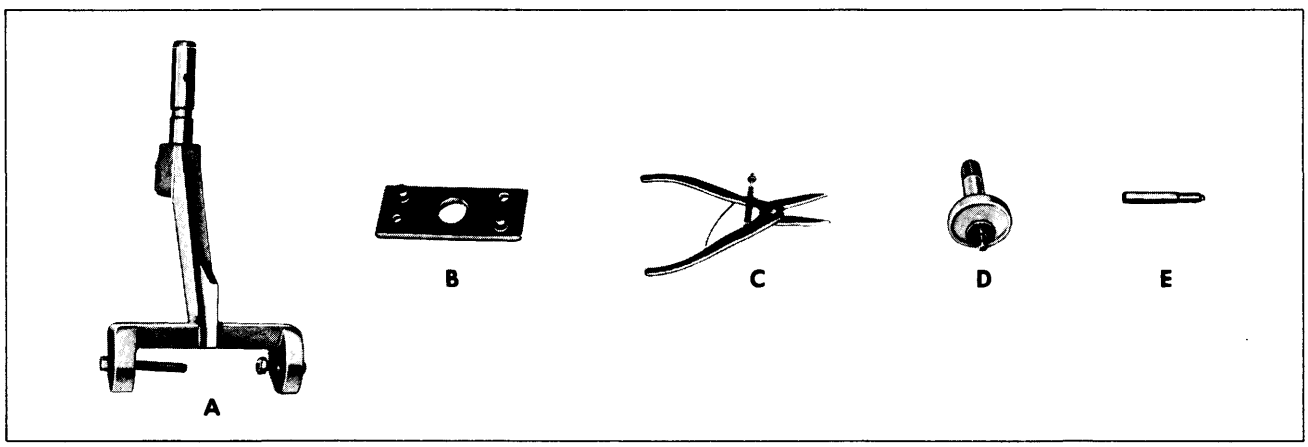


Fig. 7-216 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-22240	Transmission Holding Fixture	C	J-4646	Snap Ring Pliers
B	J-21370-8	Band Apply Adapter Plate	D	J-22241	Front Unit End Play Checking Tool
			E	J-21370-7	Band Apply Adapter Pin

(NOTE: The above Special Tools are required in addition to most tools shown in Fig. 7-114 to properly overhaul the Turbo Hydra-matic transmission used on the Eldorado.)

BACK TO INDEX

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FUEL SYSTEM

GENERAL DESCRIPTION

Design Features

The fuel tank is mounted at the rear of the car under the trunk compartment with two support straps.

The fuel tank capacity is approximately 27-1/2 U.S. gallons (23 Imperial gallons) on all models.

The fuel tank filler neck incorporates a restrictor to prevent filling the tank with leaded fuel.

The restrictor, Fig. 8-1, has an opening sized to allow entry of unleaded fuel filler nozzle and to prevent insertion of a leaded gasoline filler nozzle. When the unleaded fuel nozzle is inserted in the restrictor, the spring valve is pushed aside to allow full fuel flow.

In an emergency situation, small amounts of leaded fuel may be added. However, the restrictor and spring valve prevent filling in the normal manner.

Except in extreme emergencies, leaded gasoline should not be used as it will render the catalytic material ineffective.

(NOTE: Cadillacs built for operation in foreign countries (Option K72) do not incorporate the restricted fillerneck described above.)

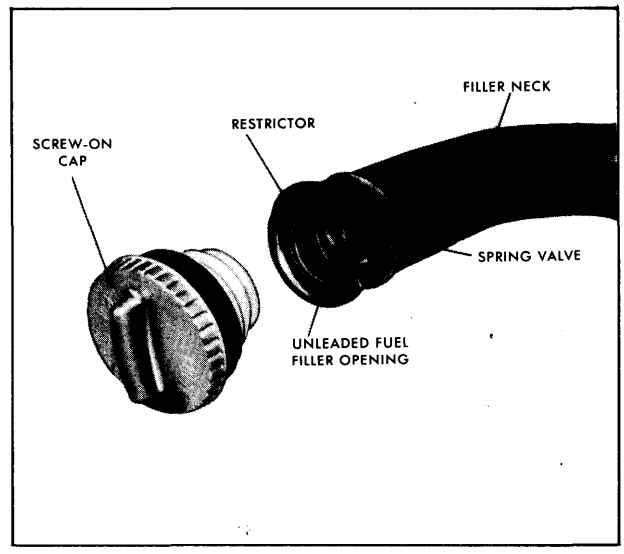


Fig. 8-1 Fuel Tank Filler Neck

All Cadillac vehicles are equipped with a system to prevent evaporation of fuel vapors from the tank. Complete information on this system is found in Section 6.

The gasoline filler cap is located behind the rear license mounting plate, which is the filler door. The hinged plate swings out from the top. The filler pipe is an integral part of the fuel tank on all cars except Commercial Chassis.

The filler cap is a screw-on type. The cap is a pressure vacuum (PV) type and is sealed to the filler neck by an O-ring. To prevent damage to the O-ring by over tightening, the cap will "ratchet" when the correct torque is applied.

The tank unit for the fuel gage is mounted near the top center of the fuel tank. It contains the float unit, which is connected to the gage unit on the instrument panel by one wire, with another wire to ground. The fuel outlet line is integral with the tank float unit assembly. It has a special plastic filter (water separator) on the inlet end. The filter has a self-cleaning action, provided by the sloshing action of the gasoline. On EFI cars the tank unit incorporates an electric in-tank fuel pump which is explained in detail in the EFI portion of Section 6.

The fuel outlet line is attached to the right hand pipe (3/8 dia.) of the gage assembly on the top center of the tank and extends along the inside of the left frame side rail except Eldorado and the inside of the right frame side rail on Eldorado to the fuel pump, Fig. 8-2.

BACK TO INDEX

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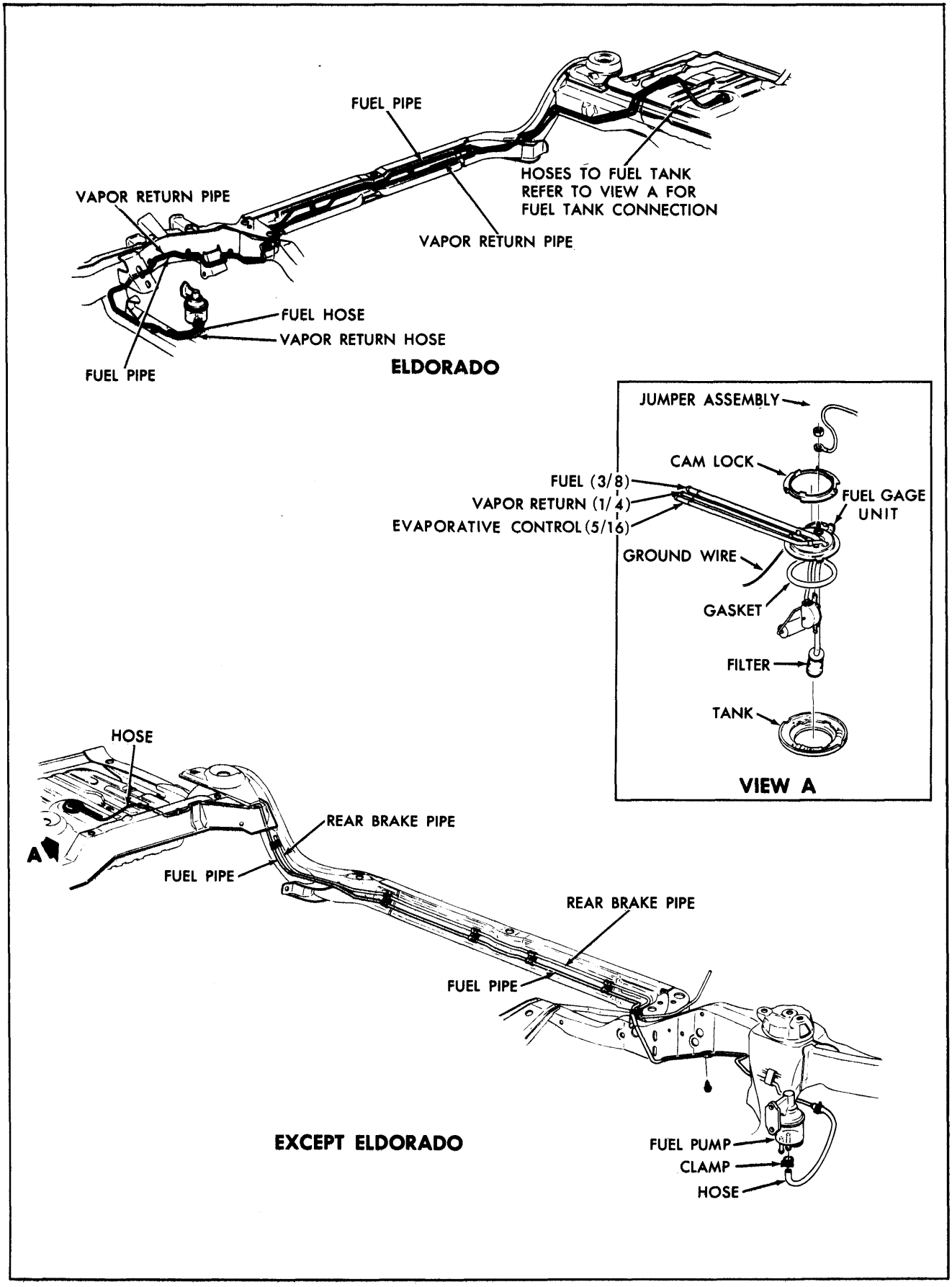


Fig. 8-2 Fuel Lines and Tank (Except EFI)

BACK TO INDEX

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SERVICE INFORMATION — FUEL SYSTEM

1. Storage Precautions

Whenever a car is to be put in storage for 30 days or longer, certain precautions should be observed. For complete details see General Information Section 0.

WARNING: THE FOLLOWING PROCEDURES SHOULD BE ADHERED TO WHEN DRAINING AND REMOVING A FUEL TANK:

- **BE SURE TO DISCONNECT BATTERY CABLES BEFORE DRAINING.**
- **PLACE "NO SMOKING" SIGNS AND A CO_2 FIRE EXTINGUISHER AT WORK AREA. WEAR SAFETY GLASSES AND SIPHON INTO A SUITABLE EXPLOSIVE PROOF CONTAINER.**

2. Fuel Tank

(NOTE: On EFI cars, refer to Section 6, Note 82.)

a. Removal

1. Disconnect battery, open fuel tank filler door and disconnect sending unit (tan) feed wire.
2. Drain fuel from tank by siphoning as described in Note 5.
3. Raise car.
4. Remove screw securing ground wire to cross member.
5. Disconnect fuel, vapor return and evaporative loss control system lines at front of tank. Plug all disconnected lines.
6. Support tank with jack and wood block and remove one screw from each side securing fuel tank support straps to body at front of tank.
7. Lower jack with fuel tank and remove tank.

b. Installation

1. Position tank to underbody; position fuel tank support straps under tank and loosely install screws securing straps to body.
2. Secure ground wire to rear cross member.
3. Tighten tank strap screws until bottomed. Torque to 25 ft. lbs.
4. Connect fuel, vapor return and evaporative loss control system lines.
5. Lower car.
6. With fuel filler door open, connect sending unit (tan) feed wire.
7. Replace fuel drained from tank.

3. Fuel Tank Strap

a. Removal

1. Raise car and support tank.
2. Remove screw securing strap to body at front of tank.
3. Remove torx screw securing strap to body at rear of tank using Tool J-24392 or No. 30 torx bit.
4. Remove strap.

b. Installation

1. Install strap in hanger at rear of tank.
2. Secure strap to body with one torx screw using Tool J-24392 or No. 30 torx bit.
3. Secure other end of strap to body at front of tank with one screw.
4. Lower car.

4. Fuel Line and Tank Cleaning

Occasionally it may be necessary to clean out fuel line and tank to remove foreign particles from system. Frequent replacement of fuel filters and excessive deposits of dirt in the fuel inlet strainer are indications that this may be necessary.

a. Fuel Line

To clean out fuel line, disconnect line at fuel pump or fuel rail and at fuel tank, blow compressed air through the line in direction opposite to fuel flow, and reconnect line.

b. Fuel Tank

For cleaning fuel tank, tank must be removed from car and flushed out to remove all foreign materials. Fuel strainer also should be inspected and replaced if necessary.

(NOTE: If trouble is due to contaminated fuel or foreign material that has been put into the tank, it can usually be cleaned. If tank is rusted internally, it should be replaced.)

1. Disconnect battery and HEI feed wires.
2. Drain fuel tank by siphoning as described in Note 5.
3. Remove fuel tank as described in Note 2a.
4. Locate tank away from heat, flame, or other source of ignition. Remove fuel gage unit from tank using Tool J-24187, and inspect condition of filter. If filter is contaminated, a new filter should be installed upon reassembly.
5. Complete draining of tank by rocking it and allowing fuel to run out tank unit hole.
6. Purge fuel tank with steam or running hot water for at least five minutes. Pour water out of tank unit hole (rock tank to assure complete removal of water).

BACK TO INDEX

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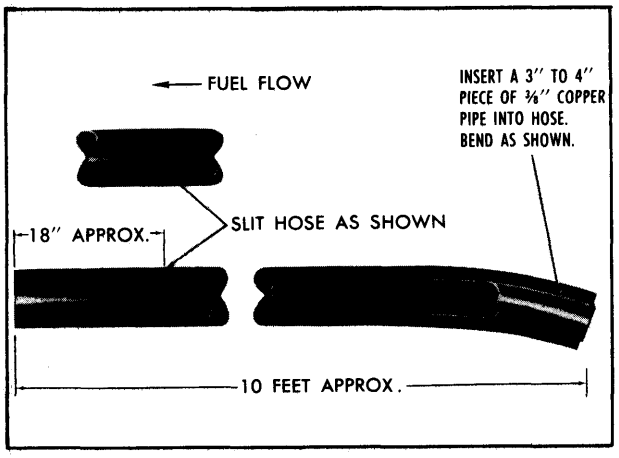


Fig. 8-3 Fuel Drain Hose

(NOTE: This procedure will not remove fuel vapor. Do not attempt any repair on tank or filler neck where heat or flame is required.)

7. Disconnect inlet fuel line at pump and use air pressure to clean fuel line and vapor return line. Apply air pressure through line in the direction opposite to normal fuel flow.
8. Use low air pressure to clean pipes on tank unit.
9. Install new filter on fuel gage unit, if required. Using Tool J-24187, install fuel gage unit with new gasket into tank. Install tank as described in Note 2b. Connect tank unit wires and all fuel lines.
10. Disconnect fuel line at carburetor or fuel rail, connect a hose to fuel line and insert other end of hose into a one gallon fuel can.
11. Connect battery cable. Make sure HEI feed wires are disconnected.
12. Put six gallons of clean fuel in tank and operate starter to pump two quarts of fuel into fuel can. This will purge fuel pump. On EFI cars turn key on and off several times (pump will only operate for 1 second unless engine is cranked.
13. Remove hose and connect fuel line to carburetor or fuel rail.
14. Connect HEI feed wires.

5. Draining Fuel Tank

1. Using approximately 10 feet of 3/8" I.D. Hose, cut a slit 18" from one end. Make the slit towards the short end. (Fig. 8-3)
2. Insert a 4" piece of 3/8" copper line into the opposite end of the hose.
3. Using a long screw driver to hold the fuel tank restrictor open, insert the copper line end of the hose into the tank with natural curl of hose pointed down until the end rests on the bottom of the tank.

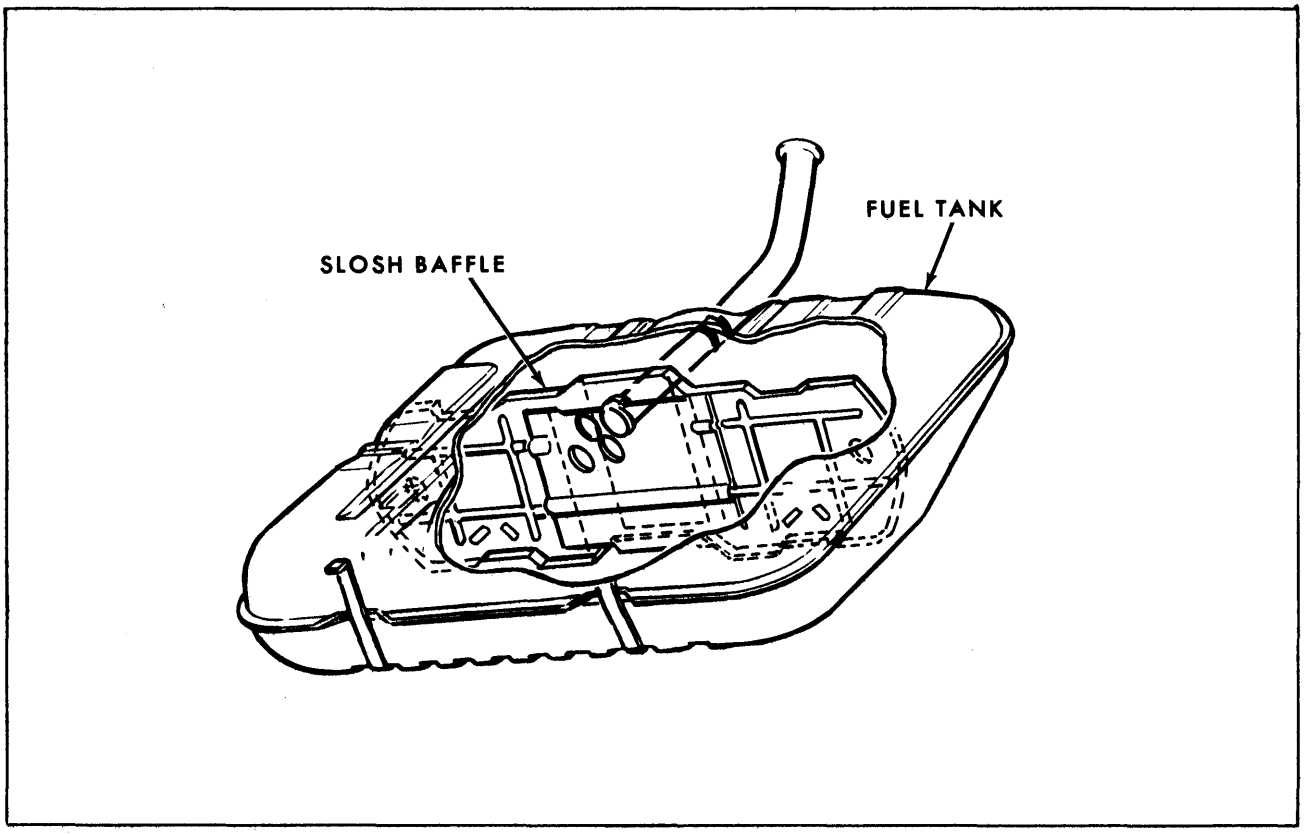


Fig. 8-4 Fuel Tank (Except E.F.I.)

BACK TO INDEX

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(NOTE: Difficulty may be experienced inserting the hose through the holes in the tank baffle. By turning the hose from side to side, continue inserting the hose through the baffle to the bottom of the tank. (Fig. 8-4)

(NOTE: Tank can be siphoned more rapidly by raising the car one foot higher in the rear than the front.)

4. Insert an air hose into the slit. A short blast of air will cause the fuel to flow.

6. Fuel Tank Float Unit and/or In-Tank Fuel Pump

a. Removal

1. Remove fuel tank as described in Note 2.
2. Remove locknut securing fuel gage tank unit and remove wire from tank unit.
3. Install Fuel Tank Sending Unit Remover and Installer, J-24187, on cam locking ring so that tool engages three tabs on ring, Fig. 8-5.
4. Install ratchet and turn counterclockwise to disengage locking ring from fuel tank. Remove tool and lift unit from tank.

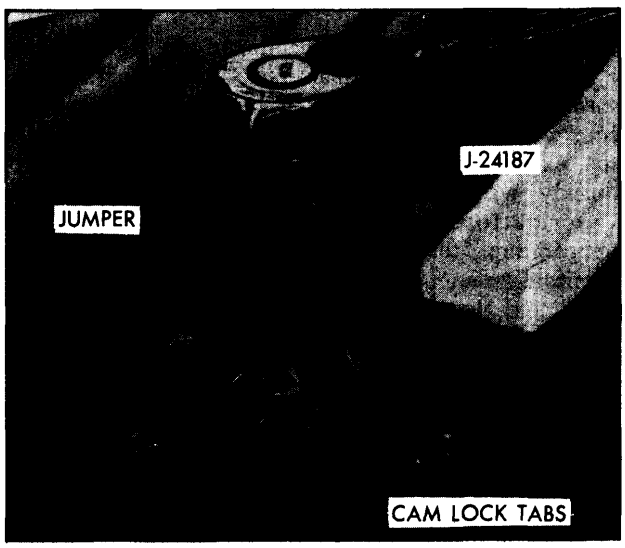


Fig. 8-5 Removing and Installing Fuel Tank Sending Unit

b. Installation

1. Install gage tank unit in fuel tank, using new gasket.
2. Install Fuel Tank Sending Unit Remover and Installer, J-24187, engaging three tabs on cam locking ring.
3. Turn locking ring clockwise until ring is fully engaged in fuel tank, then remove tool.
4. Connect fuel gage wire to gage tank unit and secure with attaching locknut.
5. Install fuel tank as described in Note 2.

7. Fuel Line

a. Removal

1. Raise car.
2. Remove clamps securing flexible fuel hose to fuel tank outlet and to fuel pump and disconnect lines at these points.
3. Tie a five foot length of cord to the flexible fuel hoses for installation purposes. (Cord will be used to pull lines during installation and are left with car after lines are removed.)
4. Plug hoses to prevent fuel loss.
5. Remove clips securing fuel line to right frame side rail.
6. Carefully remove fuel lines from car, leaving cord in place on car.
7. Remove clamps securing flexible fuel hose to fuel pipe and separate.

b. Installation

1. Connect flexible fuel hose to steel fuel pipe and secure with clamps. Hoses should overlap steel line at least one inch.
2. Position fuel pipe to surface of right frame side rail and secure with clips.
3. Tie cords left in car to ends of flexible hose and carefully pull fuel lines to tank and engine.
4. Remove cords.
5. Unplug lines.
6. Connect flexible hose at tank and engine and secure with clamps.
7. Lower car.

BACK TO INDEX

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EXHAUST SYSTEM

GENERAL DESCRIPTION

Exhaust System Design

The exhaust system on all Cadillac cars, except the Eldorado incorporates (in order from front to rear), a crossover Y-exhaust pipe, a catalytic converter, an intermediate pipe, a muffler and a muffler-to-resonator pipe with integral resonator, Fig. 8-7. On the Sixty Special Brougham, Fleetwood Seventy-Five, and Commercial Chassis, a longer intermediate pipe is used because of the additional length of these vehicles.

The exhaust system on the Eldorado body style, Fig. 8-8, consists of two exhaust pipes, a converter adapter, a catalytic converter, an intermediate pipe, muffler and a muffler to resonator pipe with an integral resonator assembly.

Both exhaust systems are supported at the rear of the converter; rear of the muffler; and rear of the resonator, by rubber isolated hangers to provide proper alignment.

The C-car exhaust system incorporates a vibration damper as a part of the muffler hanger assembly. It is used to absorb exhaust system vibrations and should be reinstalled as shown in Fig. 8-7 whenever the exhaust system is replaced.

Periodic maintenance of the exhaust system is not required, however, if the car is raised for other service, it is advisable to check the general condition of the catalytic converter, pipes and muffler.

Catalytic Converter

The catalytic converter, Figs. 8-7 and 8-8, is an emission control device added to the exhaust system to reduce hydrocarbon and carbon monoxide pollutants from the exhaust gas. The converter contains pellets coated with catalytic material containing platinum and palladium. The catalytic material promotes burning or oxidization of the pollutants as the exhaust gas passes thru the converter on its way to the tailpipe.

In the event that the catalytic pellets must be replaced, see Note 7.

(NOTE: The catalytic converter requires the use of unleaded fuel only.)

Unleaded gasoline is used to reduce combustion chamber deposits and to prevent lead contamination of the catalyst that will render it ineffective. Contamination of the catalyst by the use of leaded fuels will require frequent replacement of the catalytic material.

(NOTE: Cadillacs built for operation in foreign countries (Option K72) do not incorporate the catalytic converter described above.)

EFE Valve

The Early Fuel Evaporation (E.F.E.) valve is installed at the junction of the right hand exhaust manifold and exhaust pipe on all 1976 Cadillac cars except E.F.I. cars, which have a spacer, Fig. 8-6. The EFE valve is a vacuum operated "heat valve" which directs exhaust gases through the exhaust cross-over passage in the intake manifold during cold engine operation. This heating of the intake manifold provides improved fuel vaporization during warm-up. The EFE valve is controlled by a thermostatic vacuum switch (T.V.S.).

The TVS, located in the upper left front of the cylinder block, allows manifold vacuum to the EFE valve below approximately 150°F. coolant temperature. Intake manifold vacuum closes the EFE valve, forcing the exhaust gases through the crossover passage to quickly warm the intake manifold for better fuel vaporization. At approximately 150°F. coolant temperature, the TVS changes position, blocks off manifold vacuum and allows the EFE valve to open resulting in the normal flow of gases through the exhaust system.

Lubricate shaft with Manifold Heat Valve Lubricant #1050422 or equivalent if valve sticks or binds.

Exhaust System Service

Whenever a change is noticed in the sound of the exhaust system, or when exhaust gas can be detected inside the vehicle, inspect the complete exhaust system for broken or damaged parts, deterioration, broken seams or loose connections which may cause leaks. In addition, inspection for these conditions should be performed every 4 months, never to exceed 6,000 miles.

SERVICE INFORMATION

8. Exhaust System Service

When exhaust system service is required, Figs. 8-7 and 8-8 provide the necessary information for proper alignment and proper arrangement and positioning of parts. Step-by-step procedures for the replacement of individual exhaust system parts are not included as no special steps are required. Refer to Note 9 for servicing of the catalytic converter.

9. Catalytic Converter Service

In the event catalyst replacement becomes necessary or physical damage to the converter outer shell occurs, servicing should be limited to procedures in Notes 14 and 15 of this section.

BACK TO INDEX

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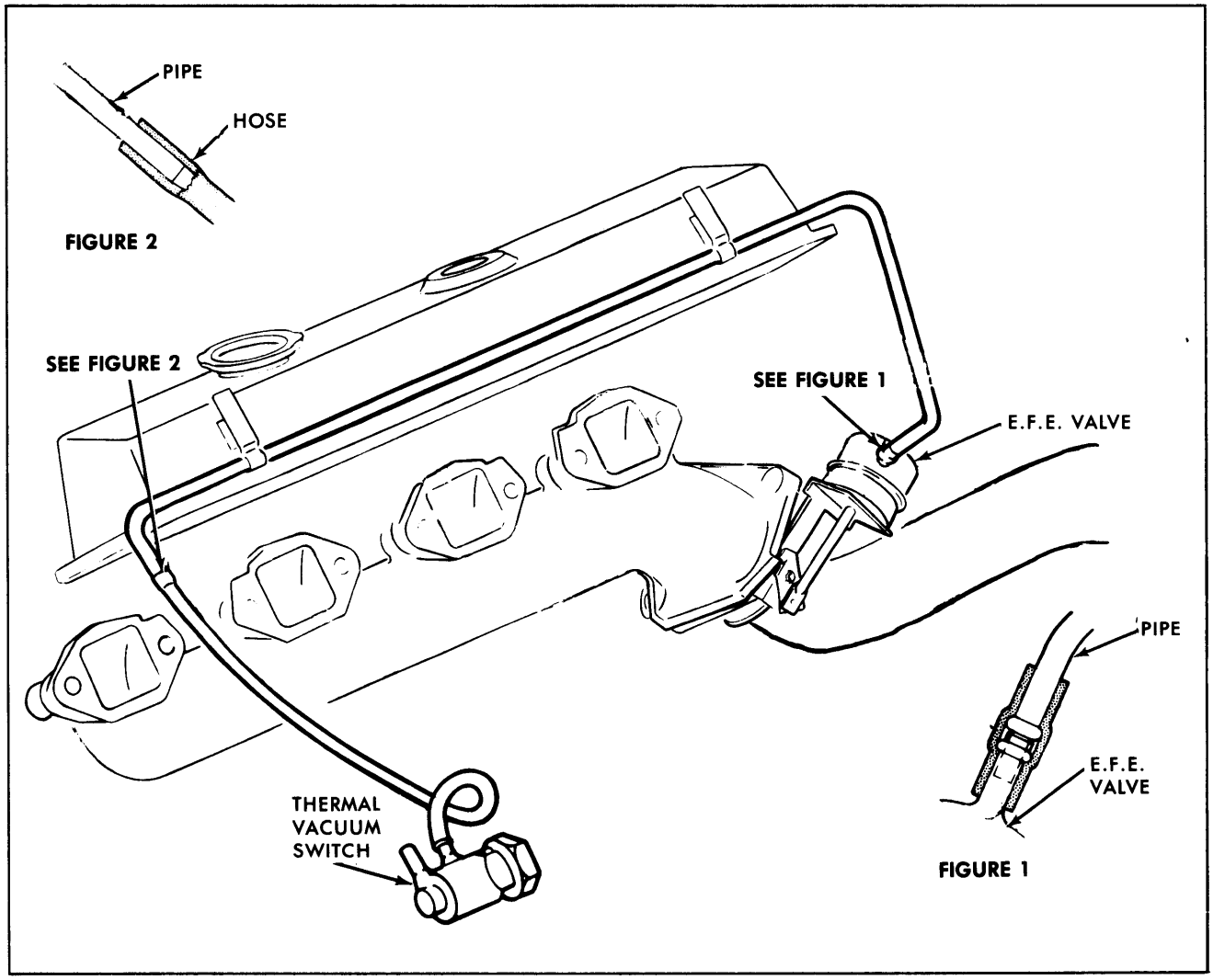


Fig. 8-6 E.F.E. Valve

10. EFE Valve (Except Eldorado)

a. Removal

1. Working under car, remove four bolts and nuts holding "Y" pipe to catalytic converter, Fig. 8-7.
2. Remove two nuts (each side) holding "Y" pipe to exhaust manifolds and remove "Y" pipe from chassis.
3. Remove vacuum hose and vacuum actuator linkage from EFE valve.
4. Remove two studs holding EFE valve to right hand manifold and remove valve.

b. Installation

1. Position EFE valve to right hand exhaust manifold with actuator towards engine block. Secure with two stud-bolts, torque to 35 Ft. Lbs.
2. Install vacuum hose and vacuum actuator linkage.
3. Secure "Y" pipe to manifolds with two nuts at each side, torque to 30 ft. lbs.
4. Secure "Y" pipe to converter with four nuts and bolts, Fig. 8-7. Torque to 35 ft. lbs.

11. EFE Valve (Eldorado Only)

a. Removal

1. Working under car remove right hand exhaust pipe by removing two nuts at each end of pipe, Fig. 8-8.
2. Remove vacuum hose and vacuum actuator linkage.
3. Remove two studs holding EFE valve to right hand exhaust manifold and remove valve.

b. Installation

1. Position EFE valve to right hand exhaust manifold with actuator towards engine block and secure with two studs, Fig. 8-8. Torque to 35 ft. lbs.
2. Install vacuum hose and vacuum actuator linkage.
3. Secure exhaust pipe with two nuts at each end. Torque to 30 ft. lbs.

BACK TO INDEX

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BACK TO INDEX

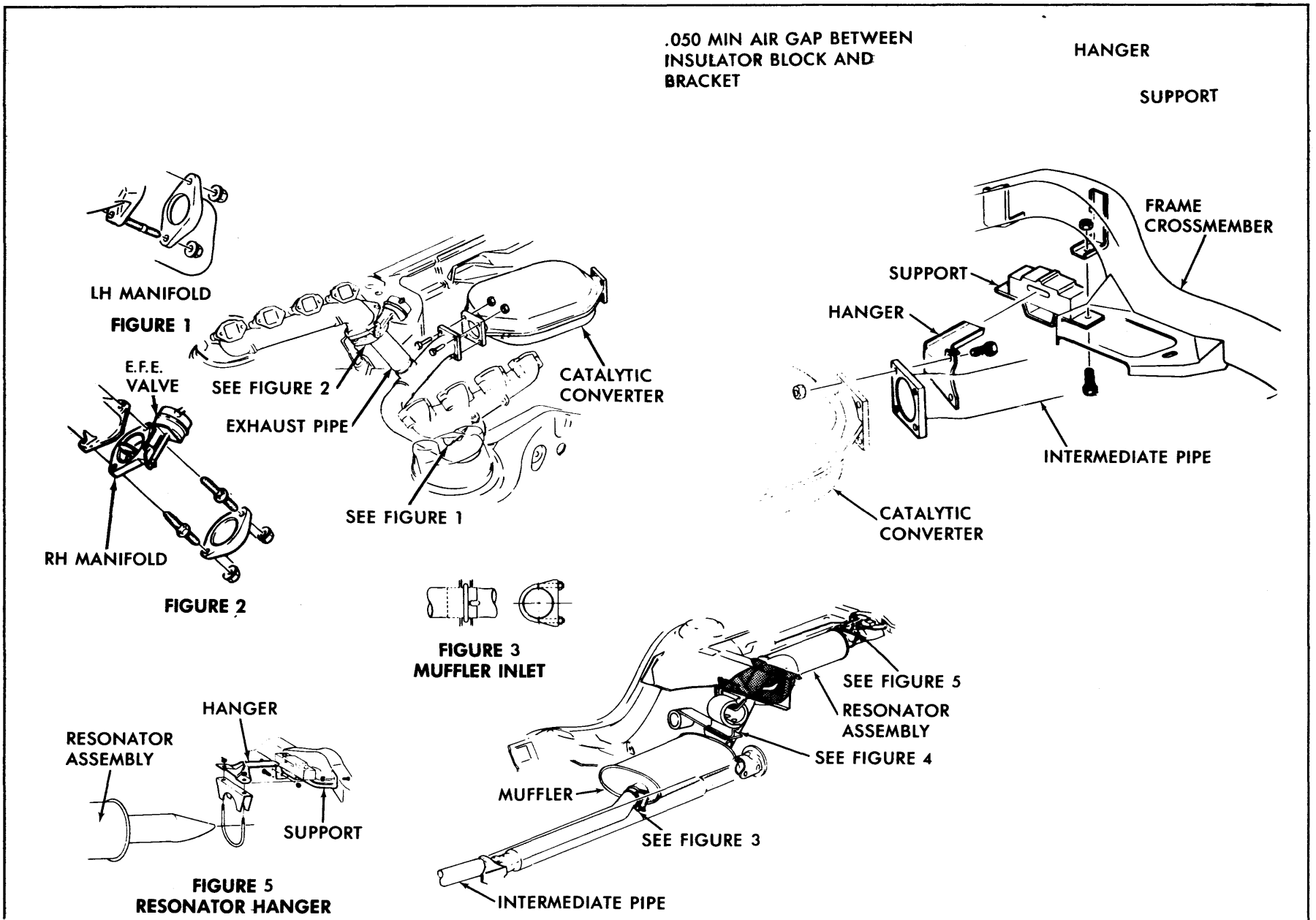


Fig. 8-7 Exhaust System—Except Eldorado

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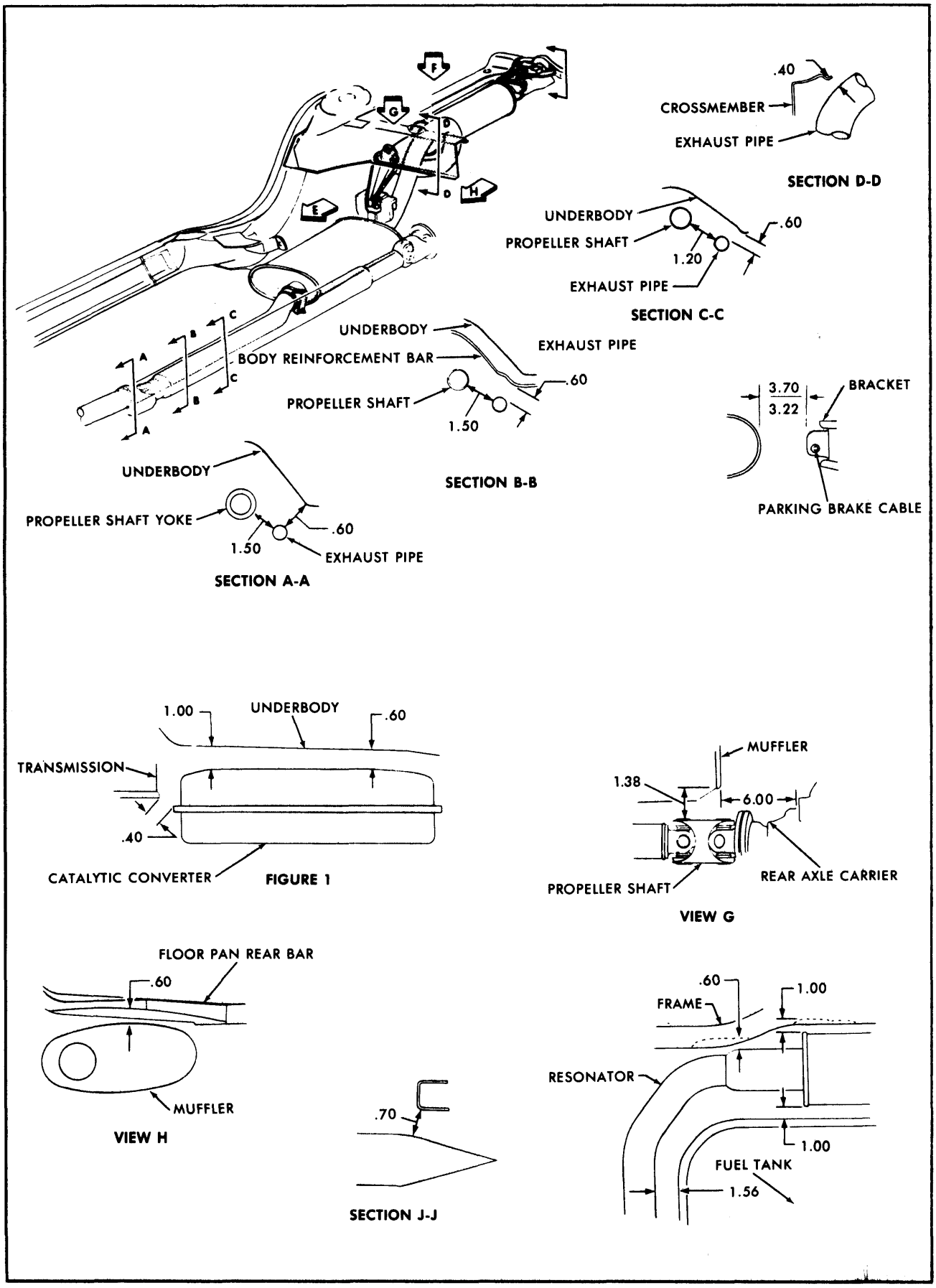


Fig. 8-7 Exhaust System Alignment—Except Eldorado

BACK TO INDEX

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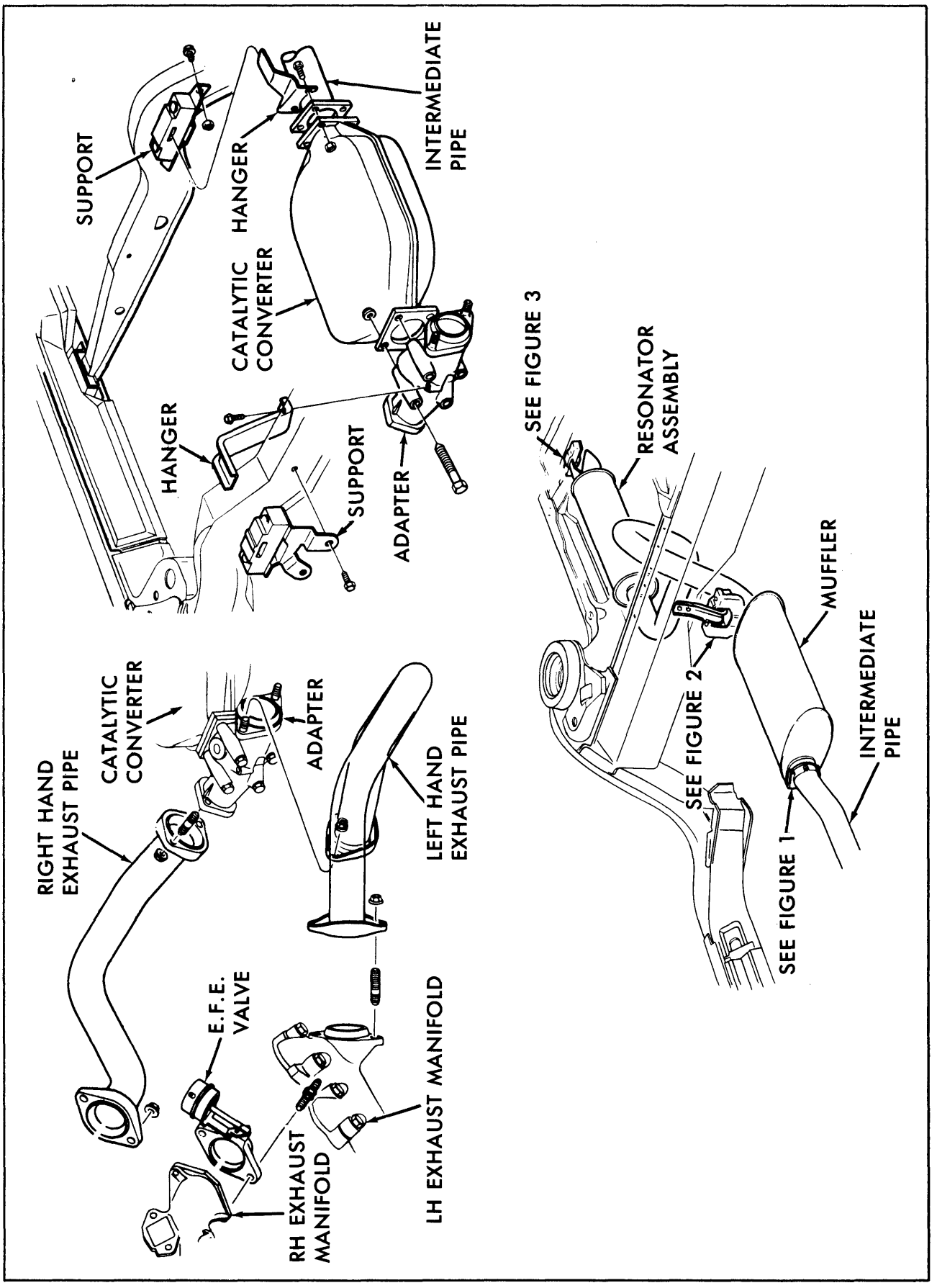


Fig. 8-8 Exhaust System Components

BACK TO INDEX

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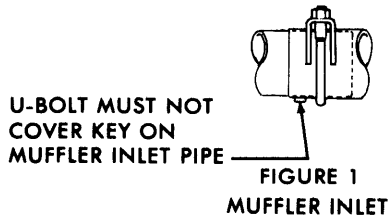


FIGURE 1
MUFFLER INLET

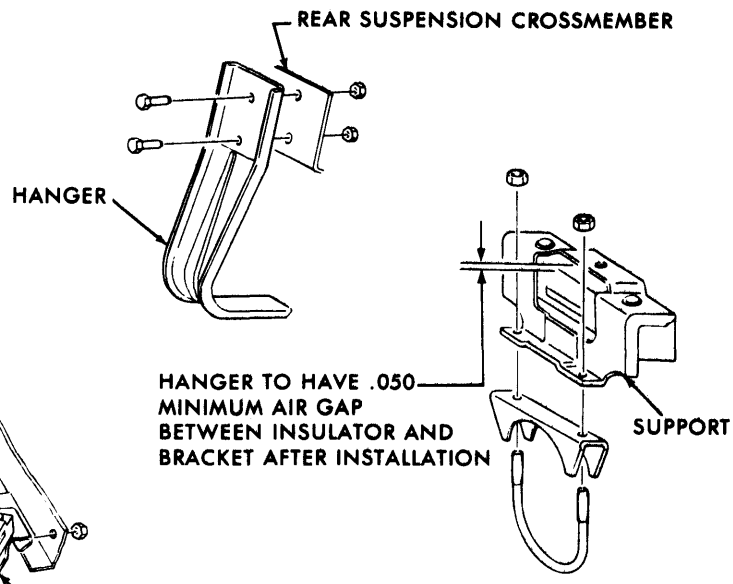


FIGURE 2
MUFFLER HANGER

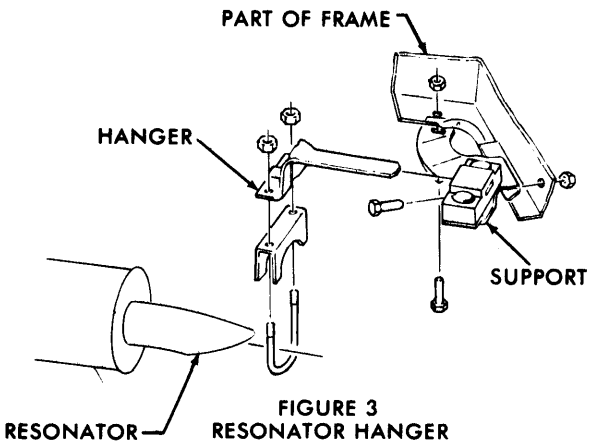
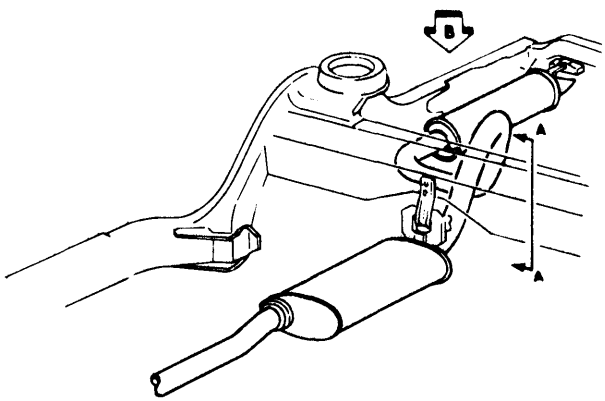
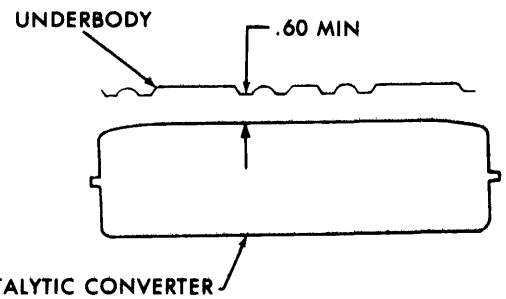
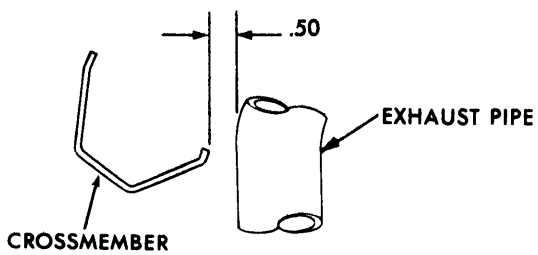


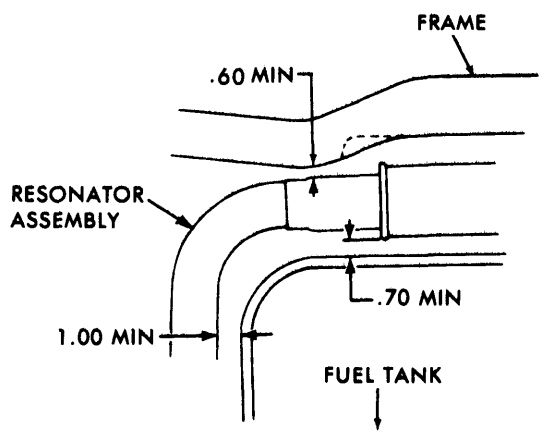
FIGURE 3
RESONATOR HANGER







SECTION A-A



VIEW B

Fig. 8-8 Exhaust System Components—Eldorado

BACK TO INDEX

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12. Exhaust System Alignment (Except Eldorado) (Fig. 8-7)

(NOTE: Exhaust system should be properly aligned to avoid contact with frame or floor pan. Blade-type exhaust system hangers are designed to minimize noise transfer through hangers. If system contacts frame or blade is bound up or restricted, vibration and noise can be transmitted into car.)

Position clamps and blades so that hanger blades are horizontal and centered from side to side in the rubber slots of the support brackets. The support brackets should also be horizontal. A light coat of silicone lubricant (not petroleum base lubricant) should be applied in rubber slots of brackets.

If it is necessary to reposition pipes, heat may be used in front of rear axle. Allow pipes to cool before touching them. Do not use acetylene torch behind rear axle.

1. Raise car.
2. Loosen clamps located at front of intermediate pipe, muffler ends, and resonator outlet.
3. Make certain system is horizontal and has adequate clearances.
4. Position clamp between intermediate pipe and muffler so there is approximately 1/8 inch between edge of muffler inlet pipe and saddle of clamp. Tighten clamp just enough to prevent separation. Then check alignment of remainder of exhaust system.
5. Position clamp between muffler outlet pipe and muffler-to-resonator pipe so there is approximately 1/8 inch between edge of muffler outlet pipe and saddle of clamp. There should be approximately 1-1/2 inch overlap of outlet pipe with muffler-to-resonator assembly.
6. Align resonator assembly to muffler so there is a minimum of one inch between outlet pipe and rear frame cross member, when measured perpendicular to the angle of pipe at outlet.
7. Check entire system again to see that there is adequate clearance with frame and body members – at least one inch (except 1/2" at frame rear cross member). Make sure that exhaust system components have at least 3/4 inch clearance from the floor pan to avoid possible overheating of the floor pan and possible damage to the passenger compartment carpets. The weight of the exhaust system should be evenly distributed on all brackets and hangers as indicated by an equal deflection at each hanger rubber. If the load is not properly balanced, reposition the pipes at the joints to relieve concentrated loads on any hangers.
8. After adjusting hangers or repositioning pipes, recheck the entire system for adequate clearance to frame members and floor pan and tighten all clamps according to torques specified in the chart on page 8-15.
9. Lower car.

13. Alignment — Eldorado Only (Fig. 8-8)

Position clamps and blades to that hanger blades are horizontal and centered from side to side in rubber slots of the support brackets. The support brackets should also be horizontal. A light coat of silicone (not petroleum base lubricant) should be applied in rubber slots of brackets. The hangers must not bind when exhaust system expands.

1. Raise car.
2. Loosen clamps located at muffler outlet and resonator outlet.
3. Check hangers. The muffler should overlap all pipes approximately 1-1/2 inch. The clamps should be positioned with 1/8 inch between the saddle of clamps and muffler pipes.
4. Make certain that resonator is horizontal and that it has a minimum of 3/4 inch clearance from fuel tank.
5. The entire system should be checked to see that there is adequate clearance to frame, suspension, drive line and body members, at least 13/16 inch. Make sure that exhaust system components have at least 3/4 inch clearance from the floor pan to avoid possible overheating of the floor pan and possible damage to the passenger compartment carpets. The weight of the system should be evenly distributed on all brackets and hangers as indicated by an equal deflection at each hanger. If load is not properly balanced, reposition the pipes at the joints to relieve any concentrated loads.
6. After adjusting hangers or repositioning pipes, recheck entire system for adequate clearance and tighten all clamps according to torques specified in the chart on page 8-15.
7. Lower car.

14. Catalyst Replacement — On Car

a. Removal

1. Install aspirator, Fig. 8-9.
2. Connect air supply line to aspirator to create a vacuum in the converter to hold catalyst in place when fill plug is removed.
3. Remove converter fill plug with 3/4" hex wrench or Tool No. J-25077-3, Fig. 8-10.
4. Clamp on vibrator, Fig. 8-11.
5. Install empty catalyst container to converter, Fig. 8-12.

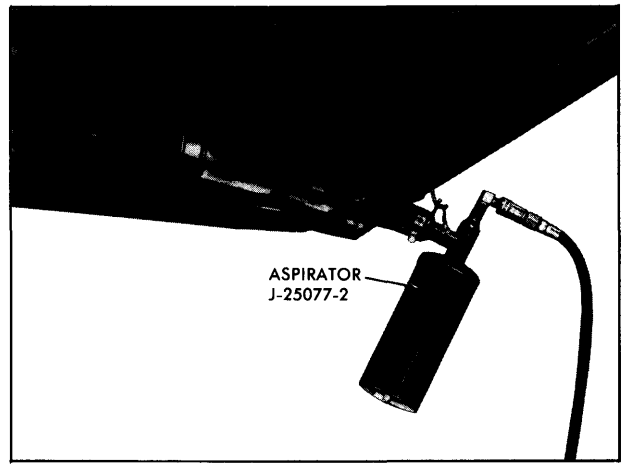


Fig. 8-9 Installing Aspirator

BACK TO INDEX

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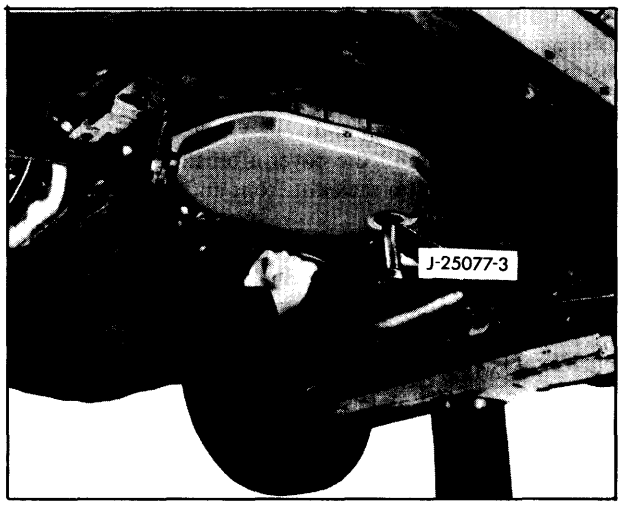


Fig. 8-10 Removing Converter Fill Plug

6. Disconnect air supply to aspirator and connect air supply to vibrator. Catalyst will now drain from the converter into the empty container.
7. When all the catalyst has been removed from the converter, disconnect air supply to vibrator and remove container from the converter.
8. Discard used catalyst.

b. Installation

1. Fill container with approved replacement catalyst.
2. Install fill tube extension to the fixture, Fig. 8-13.
3. Connect air supply to aspirator and vibrator.
4. Attach catalyst container to the fixture.

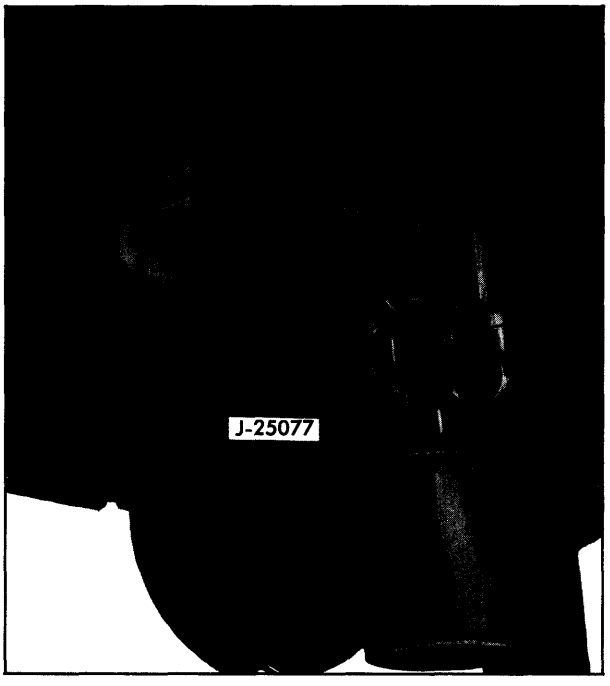


Fig. 8-11 Installing Vibrator

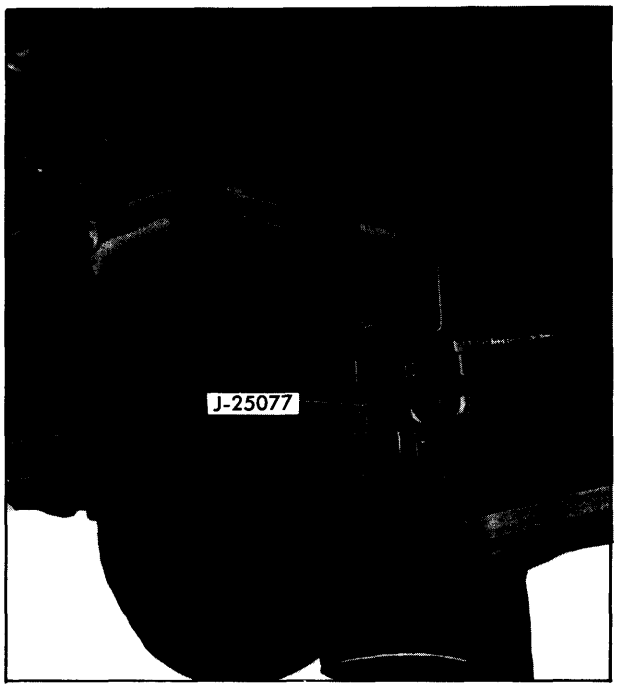


Fig. 8-12 Removing Catalyst

5. After the catalyst stops flowing, disconnect air supply to the vibrator.
6. Remove vibrator and check that catalyst has filled the converter flush with fill plug hole. Add catalyst if required.
7. Apply an anti-seize compound to the fill plug, install and tighten to 50 ft. lbs.
8. Disconnect air supply to aspirator and remove.

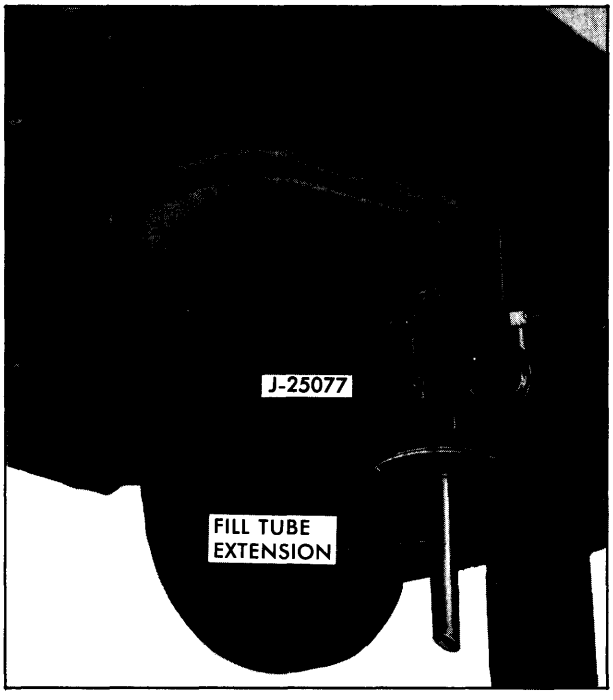


Fig. 8-13 Fill Tube Extension

BACK TO INDEX

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15. Catalytic Converter Bottom Cover Replacement

If the bottom cover of the catalytic converter is torn or severely damaged, the cover can be replaced on car with a repair kit.

1. Remove bottom cover by cutting close to the bottom outside edge, Figs. 8-14 and 8-15. Do not remove the fill plug. Depth of the cut must be very shallow to prevent damage to the inner shell of the converter.
2. Remove insulation, Fig. 8-16.
3. Inspect inner shell of converter for damage. If there is damage in the inner shell, the converter assembly must be replaced.
4. Place new insulation in the replacement cover. Apply sealing compound, Part No. 899 8245 or equivalent, all around the cover after the insulation is in position. Apply extra sealer at front and rear opening for the pipes.
5. Install replacement cover on converter, Fig. 8-17.
6. Install cover retaining channels on both sides of converter, Fig. 8-18.
7. Attach four clamps over retaining channels, two clamps at each end of converter, Fig. 8-19.

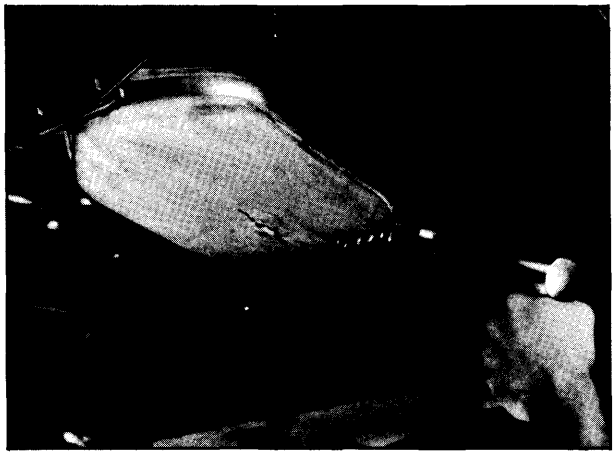


Fig. 8-14 Removing Converter Bottom Cover—1



Fig. 8-16 Removing Converter Insulation



Fig. 8-15 Removing Converter Bottom Cover—2

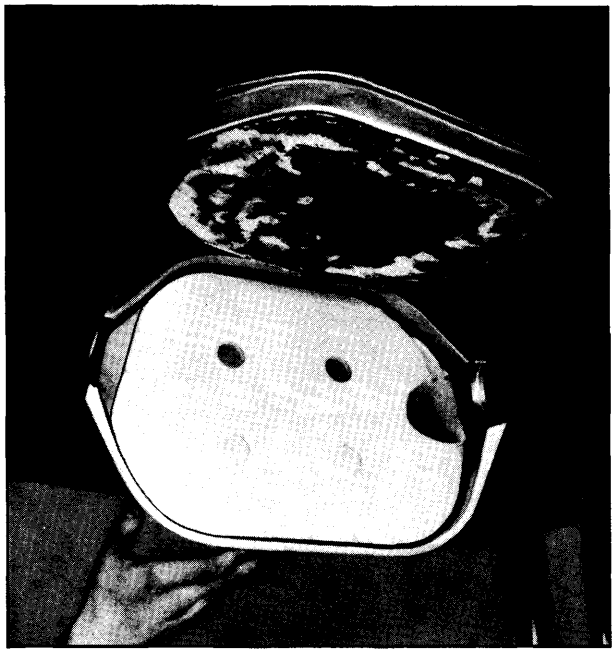


Fig. 8-17 Installing Replacement Cover on Converter

BACK TO INDEX

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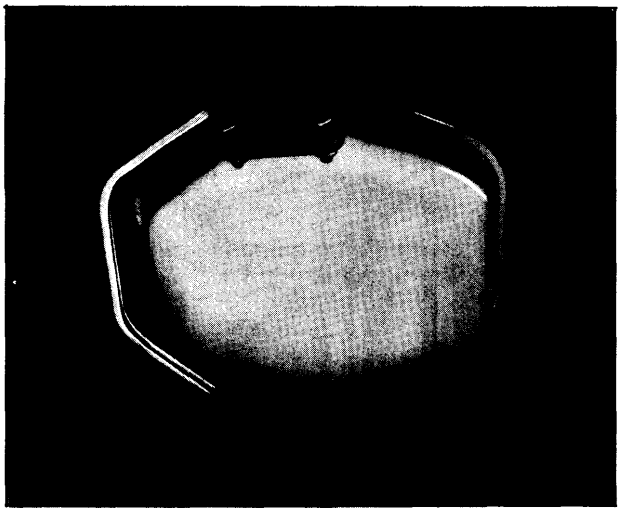


Fig. 8-18 Installing Cover Retaining Channels

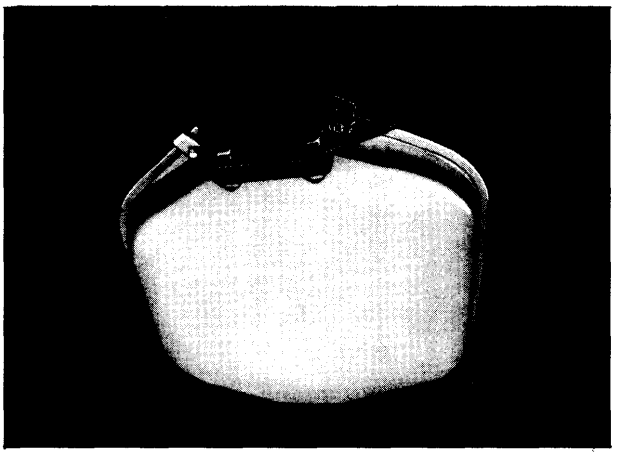


Fig. 8-19 Installing Clamps on Retaining Channels

TORQUE SPECIFICATIONS (EXCEPT ELDORADO)

Material Number	Application	Thread Size	Foot-Pounds
286-M	Exhaust Pipe Brace	5/16-18	35
286-M	Exhaust Pipe to Manifold Nuts	3/8-24	30
300-M	Exhaust Manifold Stud Bolts	3/8-24	35
286-M	Muffler and Resonator Clamp Nuts . . .	3/8-16	35
286-M	Intermediate Pipe to Exhaust Pipe Clamp Nuts	7/16-24	50
6010-M	Resonator Outlet Pipe Hanger Screw . .	20-9	10
300-M	Resonator Clamp Nuts	5/16-18	35

(NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings and steel classifications.)

TORQUE SPECIFICATIONS (ELDORADO ONLY)

Material Number	Application	Thread Size	Foot-Pounds
Special	Exhaust Pipe to Manifold Nuts	3/8-24	30
286-M	Exhaust Pipe to Y-Pipe Clamp Nuts	3/8-16	30
286-M	Muffler Clamp Nuts	3/8-16	35
6010-M	Resonator Outlet Pipe Screw	20-9	10
300-M	Resonator Clamp Nuts	5/16-18	35

(NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings and steel classifications.)

BACK TO INDEX

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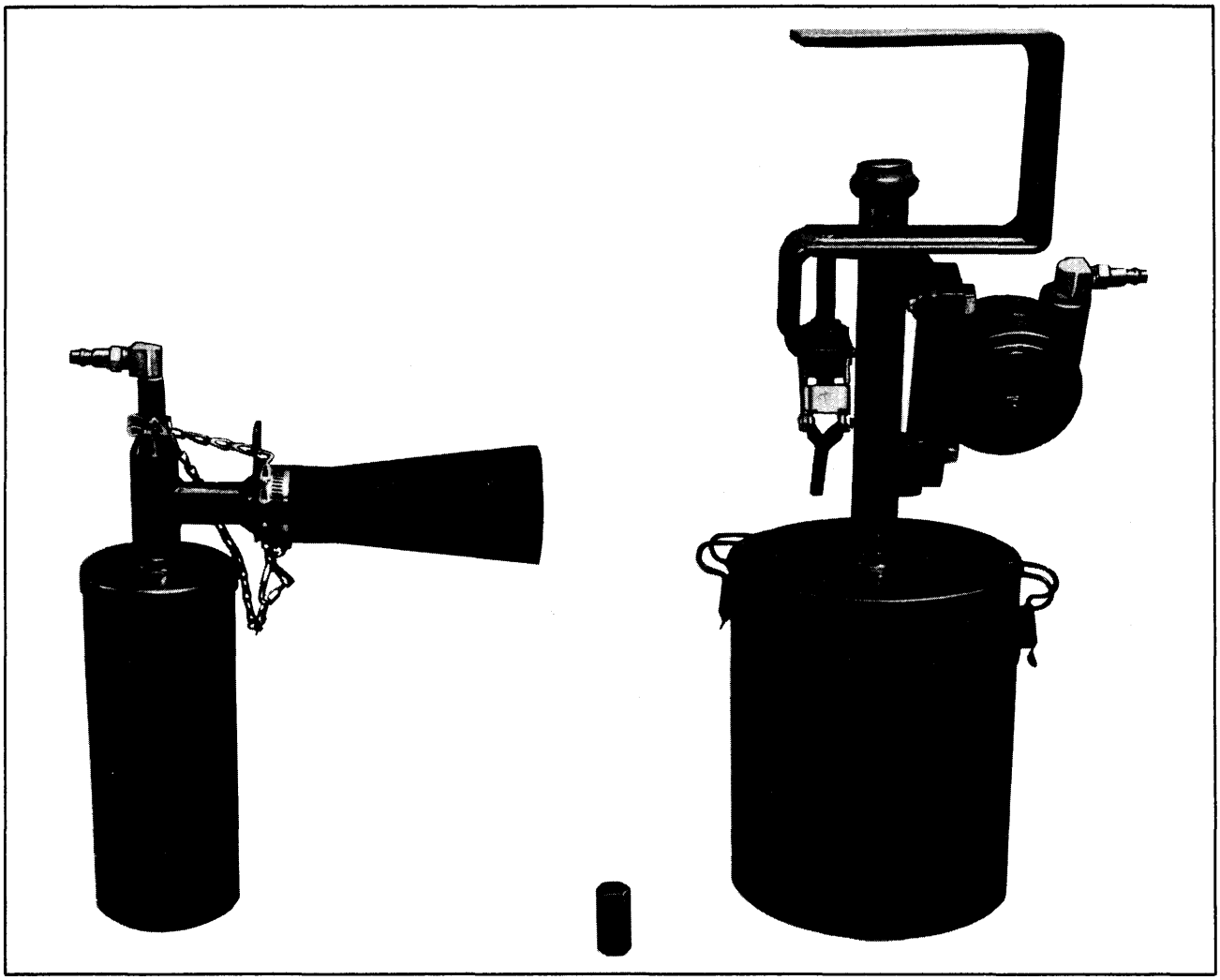


Fig. 8-20 Special Tools

Key	Tool No.	Name
A	J-24187	Cam Lock Remover
B	J-25077	Vibrator
C	J-25077-2	Aspirator
D	J-25077-3	Filler Plug Remover

BACK TO INDEX

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WARNING: IF EQUIPPED WITH AIR CUSHION RESTRAINT SYSTEM, DO NOT ATTEMPT ANY ADJUSTMENT, REPAIR OR REMOVAL OF THE STEERING COLUMN AND/OR STEERING WHEEL UNTIL THE DISCONNECTION PROCEDURE IS COMPLETED. THIS PROCEDURE MUST BE FOLLOWED TO PREVENT ACCIDENTAL DEPLOYMENT OF THE SYSTEM WHICH COULD RESULT IN PERSONAL INJURY AND/OR DAMAGE TO THE SYSTEM'S COMPONENTS.

A.C.R.S. DISCONNECTION PROCEDURE

Turn ignition switch to "LOCK" position. Disconnect the negative battery cable from the battery and tape end.

GENERAL DESCRIPTION

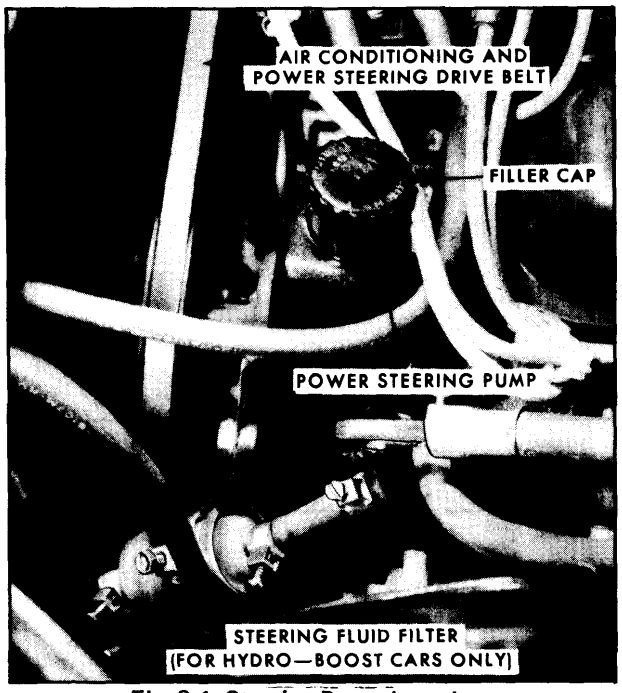


Fig. 9-1 Steering Pump Location

Service information pertaining only to those features that are exclusive to the Eldorado steering is included at the end of this section, beginning on page 9-68.

A constant ratio steering gear (17.5:1) is used on Fleetwood Seventy-Fives and commercial vehicles. Variable ratio power steering (16.0:1 on center, 13.0:1 at full turn) is utilized on all Cadillacs except Eldorado. Variable ratio power steering (20.0:1 on center, 16.0:1 at full turn) is utilized for Eldorado.

Variable ratio steering is accomplished by a pitman shaft sector incorporating a short tooth on either side of a long center tooth, rather than a sector with three teeth of equal length as in constant ratio steering.

The steering gear is mounted on the left frame side rail and is secured by three mounting screws. The gear is joined to the steering shaft by a flexible coupling that helps reduce the transmission of noises and road shock to the car interior.

A constant displacement vane type pump provides hydraulic pressure for the steering system. The pump is located on the left front corner of the engine, Fig. 9-1, and is belt driven by the engine crankshaft pulley.

Steering Linkage — Except Eldorado

The steering linkage, Fig. 9-2 consists of a pitman arm, idler arm and bracket, two pivot assemblies, and a one-piece forged steel drag link. The pitman arm connects the left side of the drag link to the steering gear and the idler arm and bracket assembly connect the right side of the drag link to the frame. The tie rods serve as connecting links between the drag link and steering arms.

All cars are fitted with serviceable pivots. They should be inspected at each engine oil change for damage or lack of enough lubricant. Enough lubricant is in the pivot if grease is expelled from the lip of the pivot seal when the seal is carefully squeezed by hand.

Damaged seal replacement and steering linkage joint lubricant are covered under notes 24 and 25.

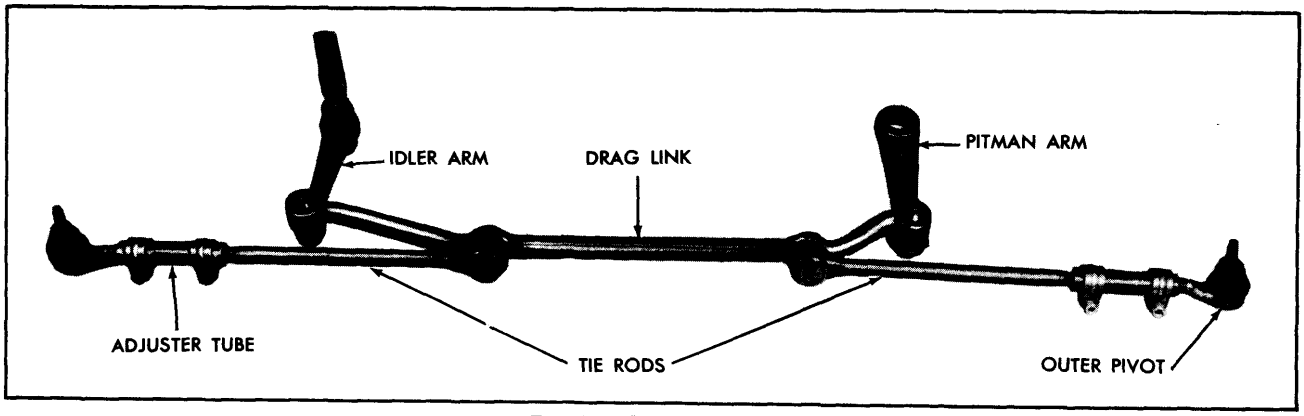


Fig. 9-2 Steering Linkage

BACK TO INDEX

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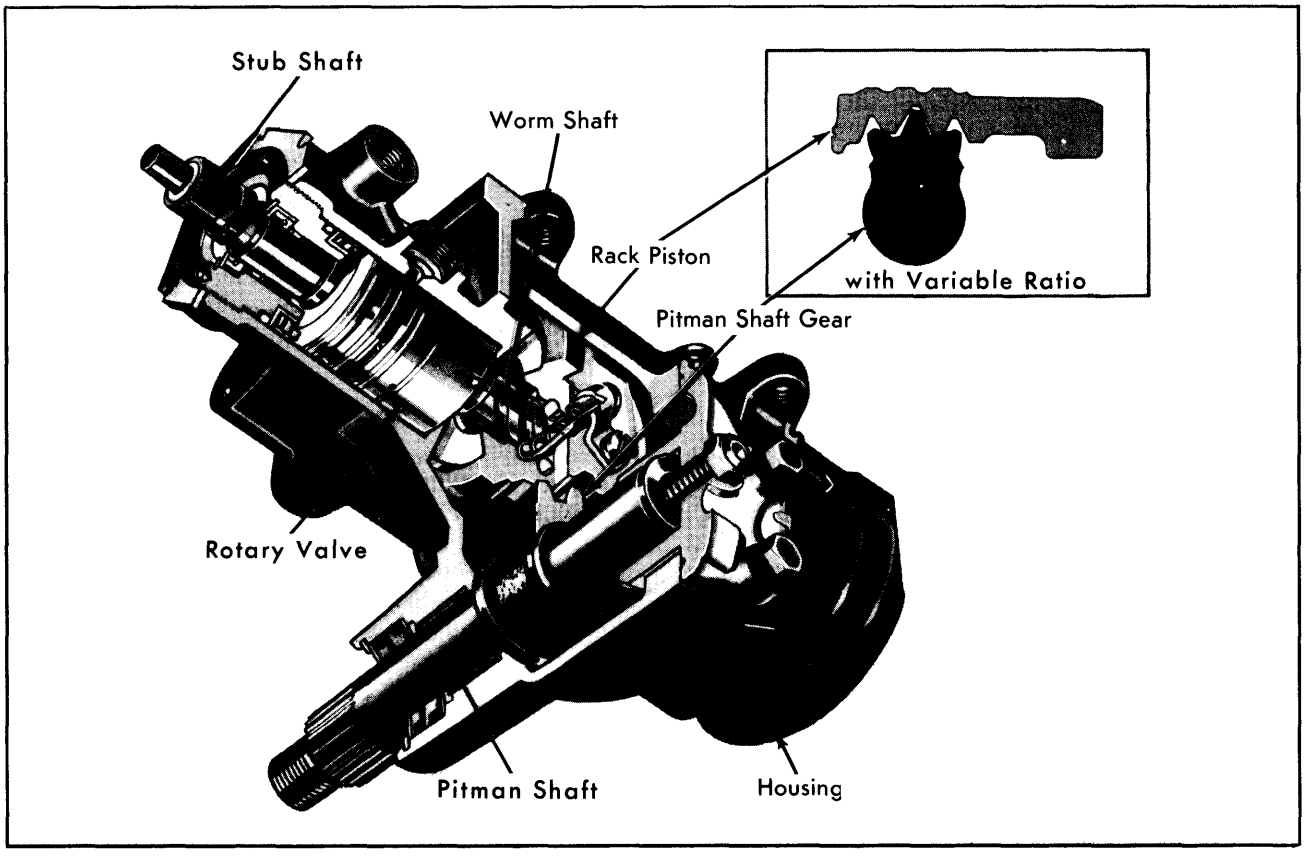


Fig. 9-3 Steering Gear Cutaway

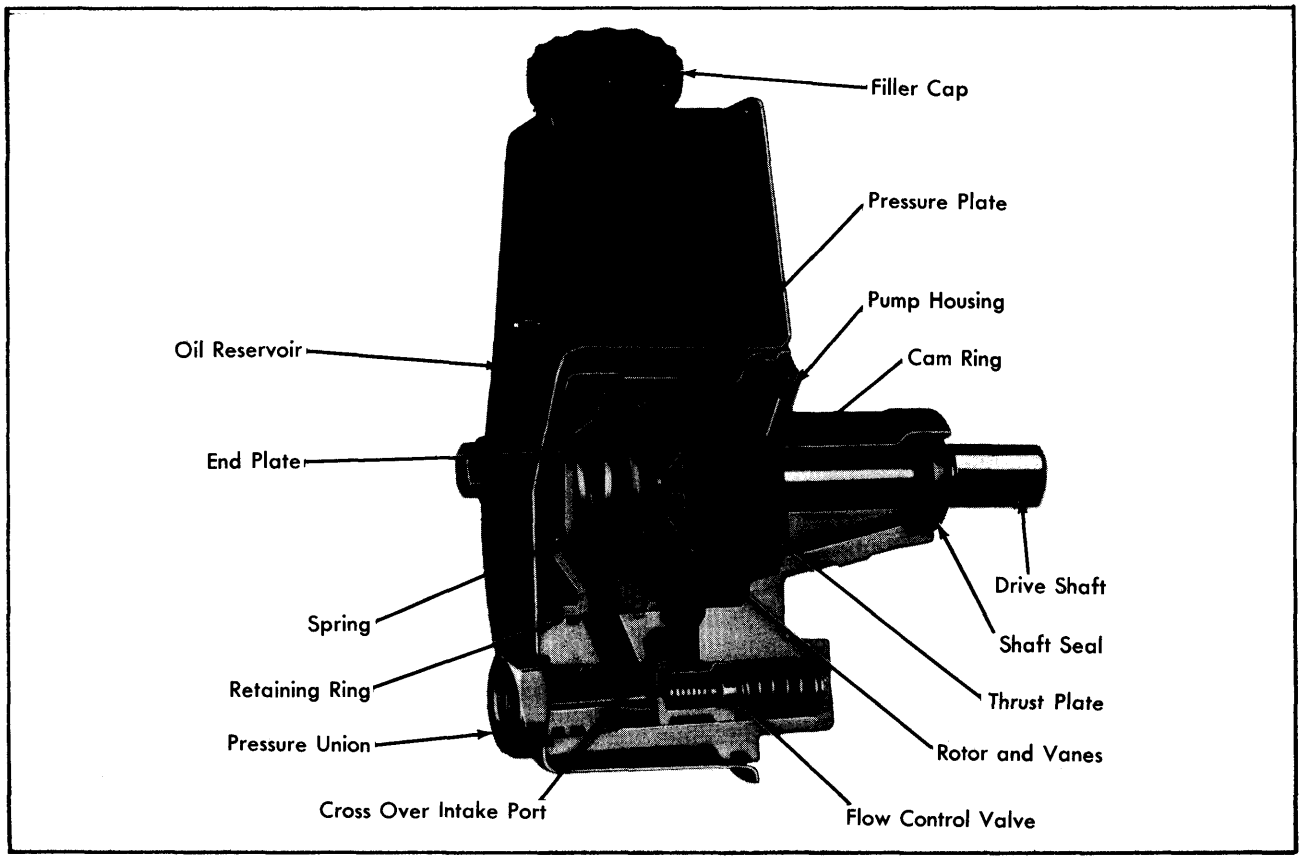


Fig. 9-4 Steering Pump Cutaway (Typical)

BACK TO INDEX

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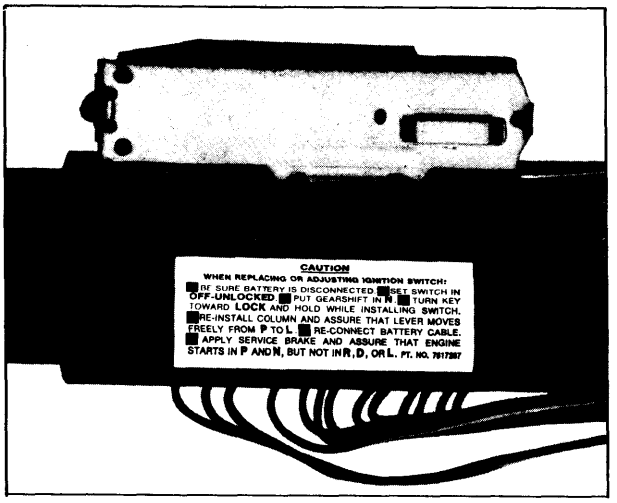


Fig. 9-5 Instruction Label

Steering Gear (Fig. 9-3)

The major internal components of the variable ratio steering gear are the rotary valve assembly steering worm, rack-piston assembly, and the pitman shaft. The movement of these parts, while turning or parking, is aided by hydraulic pressure supplied by the pump. Manual steering is always available at times when the engine is not running, or in the event of pump or belt malfunction. Steering effort is increased under such conditions.

The steering stub shaft, rotary valve, worm shaft, and rack-piston assembly are all "in line". The rack-piston in the variable ratio steering gear is modified to accommodate the larger center tooth on the pitman shaft gear. All oil passages are internal within the gear housing, except for the pressure and return hoses between the gear and the pump.

The hydraulic rotary valve is concentric with the input shaft and is contained in the upper section of the gear housing. It contains a spool that is held in neutral position by means of a torsion bar. The spool is attached to one end of the torsion bar and the valve body to the other end. Twisting of the torsion bar allows the spool to rotate in relation to the valve body, thereby operating the valve.

Under normal driving conditions the steering wheel effort will range from 1 to 1-1/2 pounds, and parking effort will range from 2 to 2-1/2 pounds.

Steering Pump

The major components of the power steering pump are the oil reservoir, drive shaft, pump housing, cam ring, pressure plate, thrust plate, flow control valve, and rotor and vane assembly. The pump housing and component parts are encased in the oil reservoir. The reservoir filler cap has a dipstick attached to show the oil level in the reservoir.

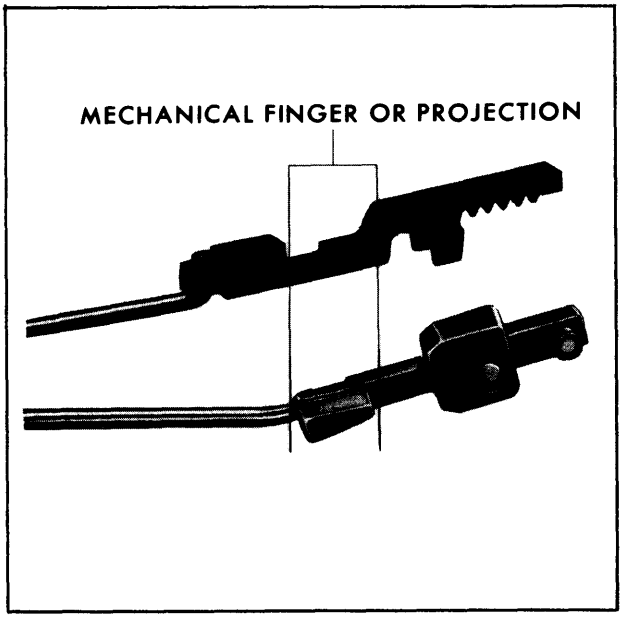


Fig. 9-6 Actuator Rack

The Steering Pump Pulley is attached and retained on the pump by a pressed fit to the steering pump shaft. Special tools are required to press the pulley onto the shaft and to remove it.

There are two bore openings at the rear of the pump housing. The larger of these openings contains the cam ring, pressure plate, thrust plate, rotor and vane assembly, and end plate. The smaller opening contains the pressure line union, flow control valve, and spring. The flow control orifice is part of the pressure line union. A pressure relief valve inside the flow control valve limits pump pressure to 1425-1475 psi.

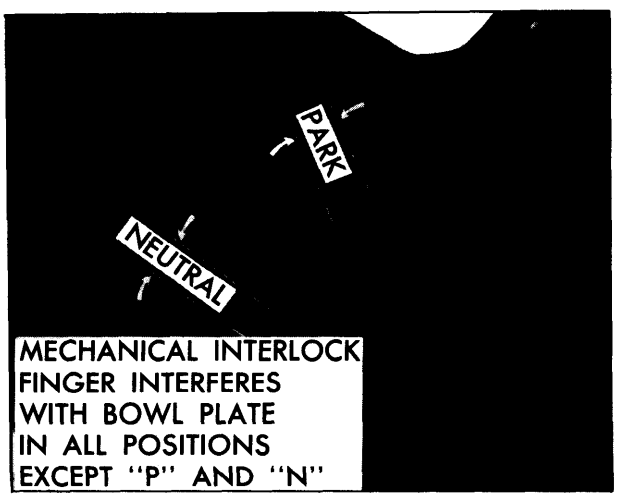


Fig. 9-7 Bowl Plate

BACK TO INDEX

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A New Steering Pump with two return ports is used on Eldorados, Fleetwood Seventy-Fives and commercial vehicles equipped with the Hydro-Boost Brake System. The pump has an additional return line which connects to the hydraulic booster.

Steering Pump Filter

A Steering Pump Return Line Filter is used on all cars equipped with the Hydro-boost Brake system. The filter is clamped to a bracket which is secured to the face of the steering pump with one screw. This filter should be replaced each time service is done that indicates contaminates have been introduced into the system.

Mechanical Neutral Start System

Cadillac steering columns contain a mechanical neutral start system. It can be identified by the yellow and black instruction label attached to the jacket adjacent to the ignition switch (Fig. 9-5). This system relies on a mechanical block, rather than the starter safety switch to prevent starting the engine in other than "P" (Park) or "N" (Neutral).

The mechanical block is achieved by a cast in finger added to the switch actuator rack (Fig. 9-6) which interferes with the bowl plate (Fig. 9-7) in all shift positions except "N" (Neutral) or "P" (Park). This interference prevents rotation of the lock cylinder into the "START" position.

In either "P" or "N", this finger passes through the bowl plate (Figs. 9-8 and 9-9) slots, allowing the lock cylinder full rotational travel into the "Start" position.

Servicing procedures remain the same as does assembly and disassembly. Some parts have been changed dimensionally and are identified as follows:

1. Mechanical neutral start system column is identified by yellow instruction tag adjacent to the ignition switch (Fig. 9-5).
2. The switch actuator rack has the projection or cast in finger and is dyed black on the standard column. The T & T column has a small strip of blue paint (Fig. 9-6).

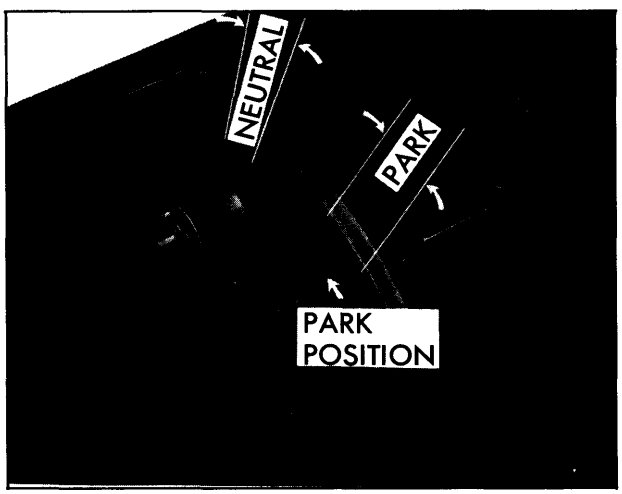


Fig. 9-8 Bowl Plate—Park Slot

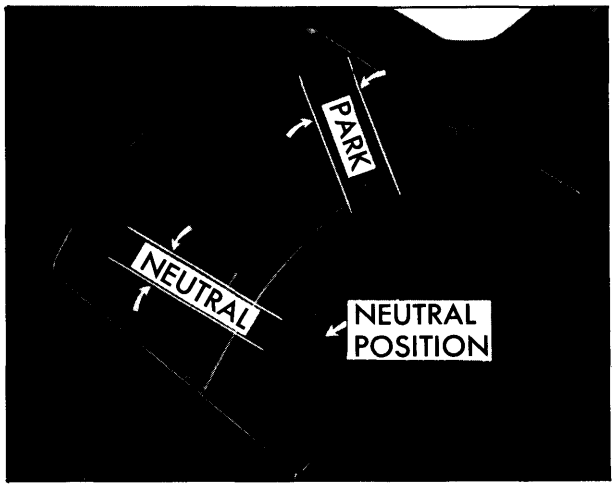


Fig. 9-9 Bowl Plate—Neutral Slot

3. The shift bowl park and neutral slots are more precise in size and location. On the standard column it is marked with yellow paint adjacent to the "Park" slot. The tilt and telescope is different in design. (Fig. 9-10)
4. The counterbore in the standard column lower bowl bearing is not as deep. This bearing is blue (Fig. 9-11).

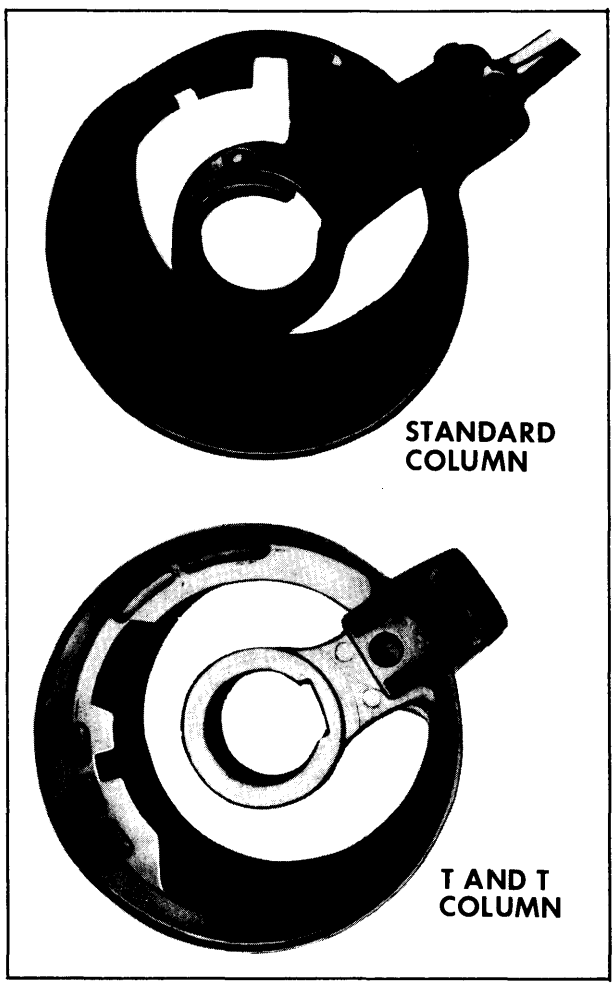


Fig. 9-10 Shift Bowl

BACK TO INDEX

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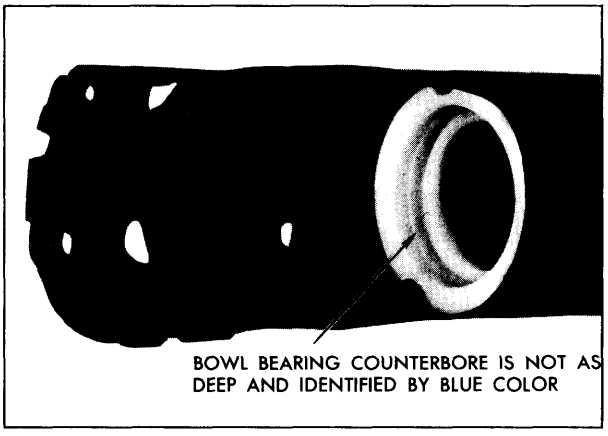


Fig. 9-11 Bowl Bearing—Standard Column

CAUTION: Do not substitute "old" style parts in service as this could defeat the mechanical neutral start system.

The ignition switch weld nuts are chamfered as shown in Fig. 9-12 and the flat-head screws chamfered as shown in Fig. 9-13. Witness marks left in the switch sheet metal help re-position the switch correctly, should maintenance be performed in this area (Fig. 9-13).

CAUTION: When replacing or adjusting ignition switch:

1. *Be sure battery is disconnected.*
2. *Set switch in OFF-UNLOCKED.*
3. *Put gearshift in "N".*
4. *Turn key toward LOCK and hold while installing switch.*
5. *Re-install column and assure that lever moves freely from "P" to "L".*
6. *Re-connect battery cable.*
7. *Apply service brake and assure that engine starts in "P" and "N", but not in "R", "D", or "L".*

If either the ignition switch or column jacket is replaced, any "witness" marks (Fig. 9-13) on the switch bracket must be removed by flattening and the ignition switch adjusted per the above procedure.

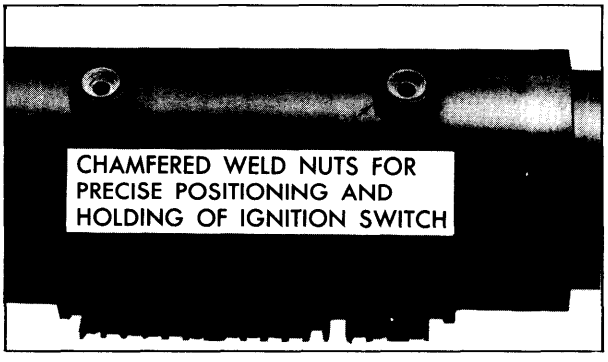


Fig. 9-12 Chamfered Nuts



Fig. 9-13 Witness Marks

CAUTION: Always check the start system as directed on the instruction label before releasing the vehicle.

Energy Absorbing Steering Column (Fig. 9-14)

The steering columns used on Cadillac automobiles are of the energy absorbing type. The outer jacket consists of two tubes of different diameters joined together by four rows of ball bearings (36 balls total) that are pressed into position. During impact, the ball bearings roll along the jacket wall allowing the smaller, lower end of the jacket to collapse within the larger upper end. The steering shaft is constructed in two parts fitting together so that they can telescope. The shift tube is constructed in two telescoping parts. An injected plastic joint holds the telescoping parts of both the steering shaft and the shift tube so that they remain in the proper relationship under normal operation.

The column is supported in the car at the upper mounting position by a bracket containing two release capsules. If an excessive impact load acts on the upper end of the column, the upper mount release capsules will shear and allow the column to collapse downward.

CAUTION: Do not use bolts longer than specified at the upper mounting capsule bracket to jacket attachment as it may adversely effect the column collapse.

Equally important is the correct torquing of all nuts and bolts. Follow exactly the torque recommendations given in every step. The column must be handled and serviced with extreme care. Use only the specified screws, bolts and nuts during assembly.

At no time should the column, shift tube, or steering shaft be struck from either end with a hammer, or pulled excessively. Care must also be taken never to let the column drop when removing or installing to prevent accidental collapse of either the steering shaft or the outer jacket.

BACK TO INDEX

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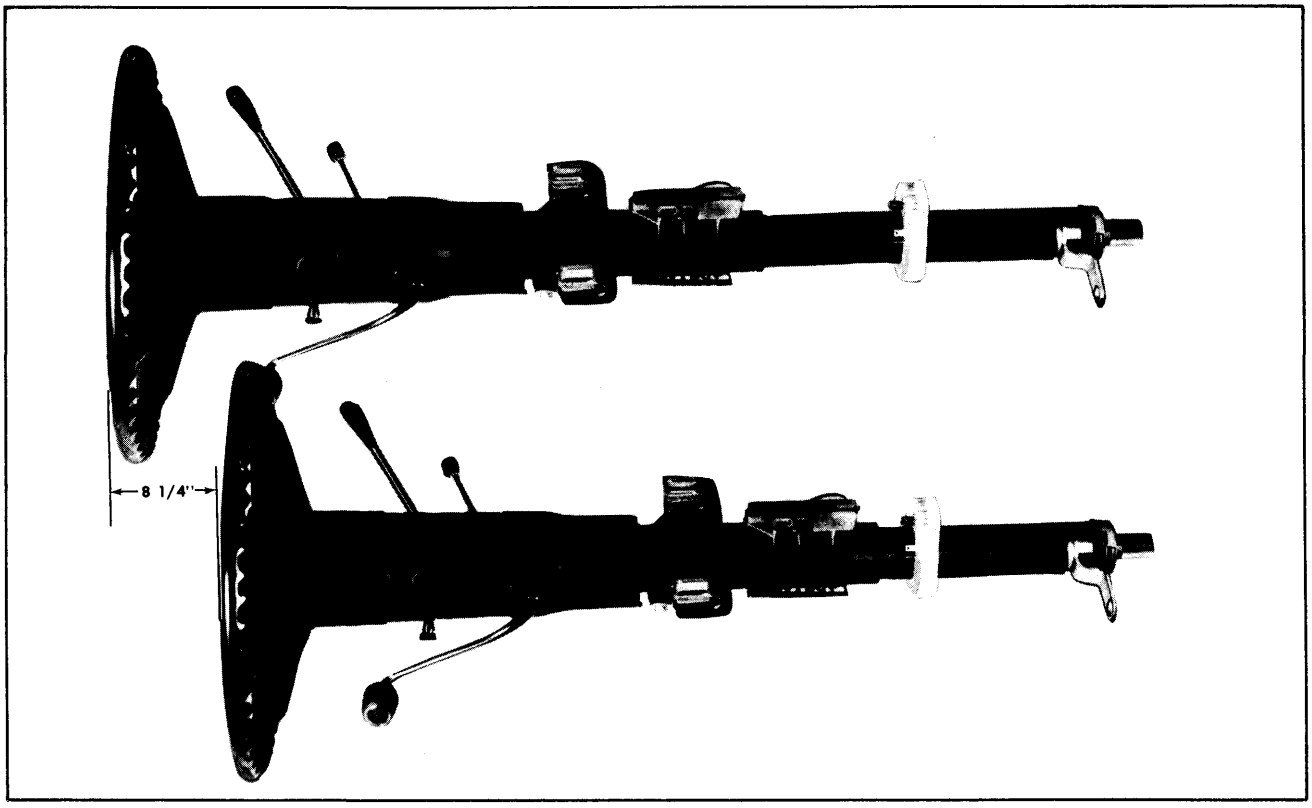


Fig. 9-14 Energy Absorbing Steering Column

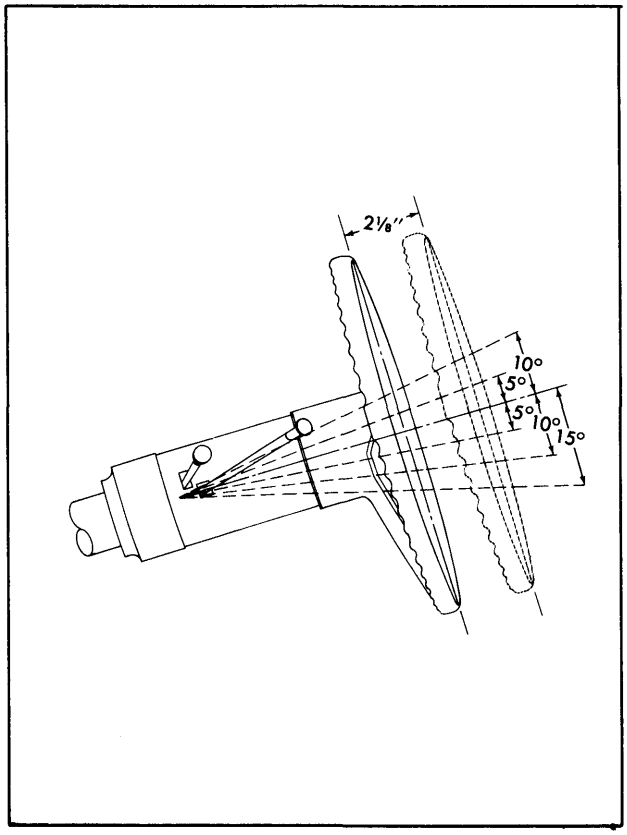


Fig. 9-15 Tilt and Telescope Steering Wheel

Tilt and Telescope Steering Column (Figs. 9-15 and 9-88)

The Tilt and Telescope steering column consists of a steering shaft with a spherical joint, adjusting and locking mechanism for tilt adjustment; a telescoping upper shaft and yoke assembly, and locking mechanism for telescopic adjustment. These adjustments are made independently of each other.

The up and down tilt action is achieved by pulling upward on a small lever located on the left side of the steering column just below the directional signal lever, which allows the steering wheel to be positioned at any one of six possible angles. Releasing the lever will lock the wheel in position.

A knob located at the top of the steering column, where it meets the steering wheel, releases the steering column telescoping mechanism for adjustment. To lengthen or shorten the steering column within its range, move the telescope lock-unlock knob fully left, push or pull the steering wheel to the desired position, and move the lock-unlock knob fully right.

Service operations on the steering gear, power steering pump, and steering linkage are exactly the same on cars equipped with a Tilt and Telescope wheel as on cars with the standard wheel. Steering gear adjustments are performed in the same manner and to the same specifications. Steering column to gear alignment and steering wheel alignment also are the same.

BACK TO INDEX

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STEERING SYSTEM DIAGNOSIS

Complaints of faulty steering are frequently the result of problems other than the steering gear or pump. Those areas of the steering system which can be easily checked and quickly corrected without disassembly and overhaul of any major components should be attempted first.

Conditions such as hard or loose steering, road shock or vibrations are not always due to the steering gear or pump, but are often related instead to such factors as tire pressure and front end alignment. These factors should be checked and corrected before any adjustment or disassembly of the power steering gear or pump is attempted.

Many factors affect proper operation of the steering system, of which the most common are:

1. Fluid level.
2. Drive belt tension.
3. Loose component mountings.
4. Coupling alignment, axial and lateral.

These factors must be checked and corrected before making any further diagnosis of the steering system. The need for proper diagnosis cannot be over-emphasized.

Determine the Cause

After the source of the problem has been found, determine the cause. For example, if the oil level in the reservoir is found to be low, refill and check the entire hydraulic system for oil leaks. Refilling the reservoir will not necessarily correct problem.

External Leakage Diagnosis

General Procedure

1. Wipe suspected area dry.
2. Check for overfilled reservoir.
3. Check for oil aeration and overflow.
4. Check hose connections – tighten if necessary
5. Verify exact point of leakage.

Example: Torsion bar, stub shaft and adjuster seals are close together; exact leakage point could be difficult to locate.

Example: The point oil drips from is not necessarily the leakage point – oil overflowing from reservoir for instance.

6. When service is required:
   A. Clean leakage area upon disassembly.
   B. Check component sealing surfaces for damage.
   C. Replace leaking seal or seals.
   D. Reset bolt torque to specification where required.

Some of the problems associated with the power steering systems may be described as:

1. Oil leakage on garage floor.
2. Oil leaks visible on steering gear, pump, or anywhere else on the left side of engine compartment.
3. Growling noise especially when parking or when engine is cold.
4. Loss of power when parking.

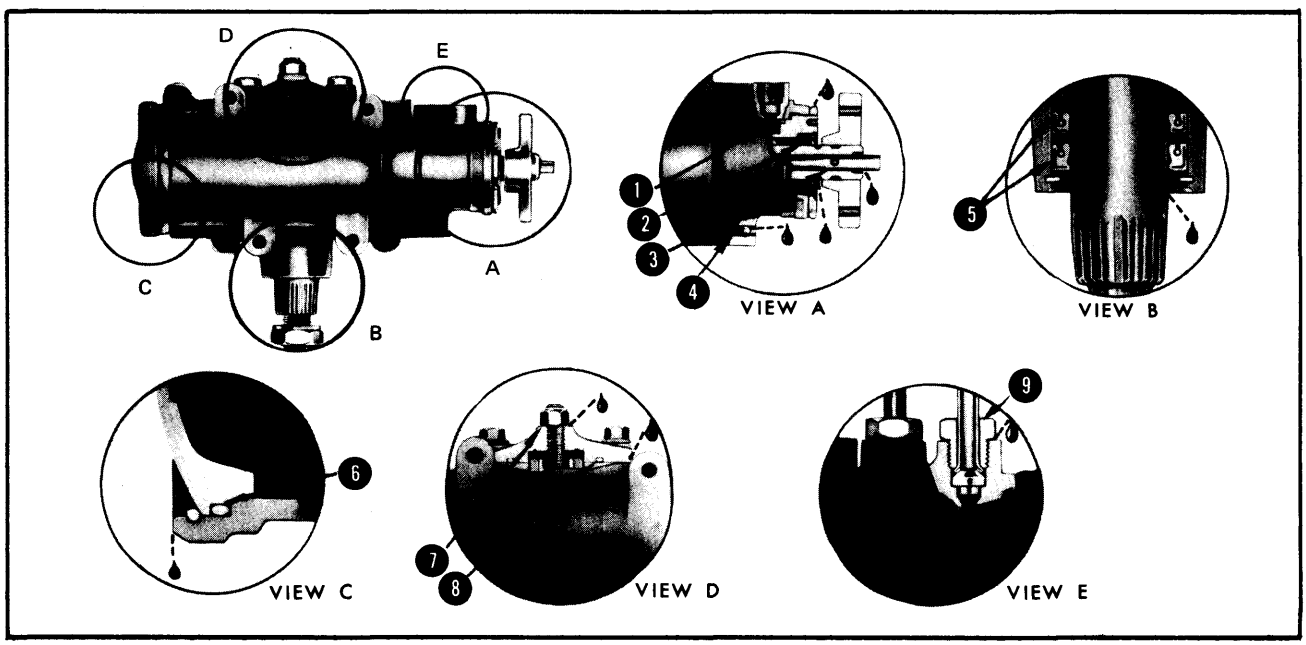


Fig. 9-16 Steering Gear Leakage Areas

BACK TO INDEX

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5. Heavy steering effort.

For the purpose of trouble shooting problems of this nature, assume that there is an external leak in the power steering system, and follow the steps given in this procedure.

This procedure is a guide, which will enable you to locate, identify, and repair leaks in the power steering system. It contains:

A. Diagram of the complete power steering system with the areas of potential leakage identified.

B. Recommended procedure for locating external leakage in the vehicle.

C. Areas of leakage to be checked, which can be serviced at once.

D. Part replacement recommendations.

E. Diagram of the actual areas where leakage will be observed and the action recommended to repair this leakage.

External Leakage Check

The purpose of the diagnostic procedure is to pinpoint the location of the leak. The method outlined in this procedure can be followed to locate the leak and repair it.

In some cases you will be able to locate the leak easily. However, seepage type leaks may be more difficult to isolate. For seepage leaks, the following method is recommended.

A. With the vehicle's engine off, wipe the complete power steering system dry (gear, pump, hoses, and connections). Also Hydraulic Brake Unit on vehicles so equipped.

B. Check oil level in pump's reservoir and bring to proper level.

C. Start engine and turn steering wheel from stop to stop several times. Do not hold for any length of time as this can damage the power steering pump. It is easier if someone else operates the steering wheel while you check for seepage.

D. Find the exact area of leakage.

E. Refer to the diagnostic chart to find the recommended method of repair.

Quick Fixes

The purpose of this section is to acquaint you with the types of leakage which can be repaired very easily. It contains information on reservoir oil level, the hoses and the hose connections.

An overfilled pump reservoir can be a cause for leakage complaint. The oil in the steering system expands as heated during normal usage. If overfilled the excess is forced through the breather cap vent and may be sprayed over the engine by air blast. Operate the engine and steering system until normal operating temperature is obtained. Remove the reservoir cap and check the graduated level on the dipstick. Add or remove fluid to bring oil to proper level. (See Note 1)

Seepage at the hose connections can be a cause for leakage complaint and can be due to loose hose connections. If leakage is observed at the hose connections, and the fitting is not cross threaded, tighten the fitting at the gear (and at Hydraulic Booster on vehicles so equipped) to 35 foot-pounds maximum.

The fitting at the power steering pump should be tightened to 45 foot-pounds maximum. If tightening to this torque does not stop the leak, refer to the diagnostic chart.

If either the return hose or the pressure hose leaks, replace the hose.

Component Replacement Recommendations

Lip seals, which seal rotating shafts, require special treatment. This type of seal is used on the steering gear at the pitman shaft, at the stub shaft, and on the drive shaft of the pump. When leakage occurs in one of these areas, always replace the seal or seals, after inspecting and thoroughly cleaning the sealing surfaces. Replace the shaft only if very severe pitting is found. If the corrosion in the lip seal contact zone is slight, clean the surface of the shaft with crocus cloth. Replace the shaft only if the leakage cannot be stopped by smoothing with crocus cloth first.

Housing or Cover Seepage – Both the power steering gear and pump assemblies are leakage checked before shipment. However, occasionally oil seepage may occur from the gear or pump other than from the seal areas. If this type of leakage is found, replace the leaking part.

Individual Leakage Breakdown

The following diagrams have been prepared to show the potential areas of leakage. If leakage occurs in the areas shown, replace the part listed.

Gear

Pay particular attention to the exact source of leakage in this area. Due to the closeness of the various seals, the wrong diagnosis will result in an ineffective repair.

Action to be taken

1. Replace adjuster plug "O" ring seal. (Fig. 9-16 View A)
2. Replace dust and stub shaft seals. (Fig. 9-16 View A)
3. Replace rotary valve assembly. (Fig. 9-16 View A)
4. Seat ball flush with punch and restake. If seepage persists, replace housing. (Fig. 9-16 View A)
5. Replace both pitman shaft seals. (Fig. 9-16 View B)
6. Replace end plug "O" ring seal. (Fig. 9-16 View C)
7. Tighten nut to 35 foot-pounds. Replace nut if leakage persists. (Fig. 9-16 View D)

BACK TO INDEX

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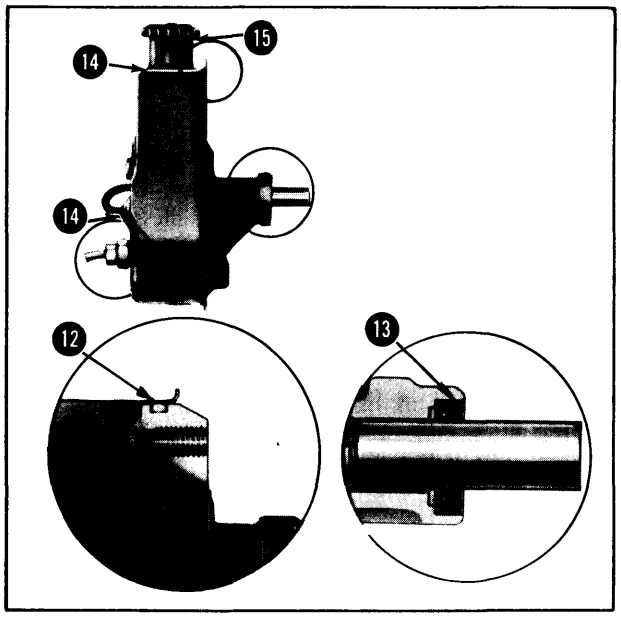


Fig. 9-17 Steering Pump Leakage Areas

HYDRAULIC BRAKE BOOSTER LEAKAGE:

See Section 5, Hydro-Boost Leak Diagnosis.

8. Tighten side cover screws to 45 foot-pounds. Replace side cover seal if leakage persists.

(Fig. 9-16 View D)

9. If leakage persists upon tightening the fitting nut to specified torque replace brass connector and reface hose tube flare. If leakage is due to damaged threads (cross threaded), replace brass connector. Repair fitting nut or replace hose as required. If housing threads are badly stripped, replace housing.

(Fig. 9-16 View E)

Pump (Fig. 9-17)

Action to be taken

10. Tighten hose fitting nut to specified torque. If leakage persists, replace discharge fitting and reface hose tube flare or replace hose as required.

11. Tighten fitting to specified torque. If leakage persists, replace both "O" ring seals.

12. Replace reservoir "O" ring.

13. Replace pump shaft seal.

14. Bent or cracked reservoir, replace reservoir.

15. Check oil level. If leakage persists with the correct fluid level and the cap tight, replace the cap.

BACK TO INDEX

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STEERING GEAR AND PUMP DIAGNOSIS CHART

CONDITION	CAUSE	CORRECTION
Hissing noise in steering gear. (On hydraulic brake booster equipped cars, a hiss noise will be noticed whenever the brake pedal is depressed heavily. This is normal and in no way affects steering.)	There is some noise in all power steering systems. One of the most common is a hissing sound most evident at standstill parking. There is no relationship between this noise and performance of the steering. "Hiss" may be expected when steering wheel is at end of travel or when slowly turning at standstill.	Slight "hiss" is normal and in no way affects steering. Do not replace valve unless "hiss" is extremely objectionable. A replacement valve will also exhibit slight noise and is not always a cure for the objection. Investigate clearance around flexible coupling rivets. Be sure steering shaft and gear are aligned so flexible coupling rotates in a flat plane and is not distorted as shaft rotates. Any metal-to-metal contacts through flexible coupling will transmit valve "hiss" into passenger compartment through the steering column.
Rattle or chuckle noise in steering gear.	Gear loose on frame. Steering linkage looseness. Loose pitman shaft over center adjustment. Pressure hose touching other parts of car. (NOTE: A slight rattle may occur on turns because of increased clearance off the "high point." This is normal and clearance must not be reduced below specified limits to eliminate this slight rattle.) Loose pitman arm.	Check gear-to-frame mounting screws. Tighten screws to specified torque. Check linkage pivot points for wear. Replace if necessary. Adjust to specifications. Adjust hose position. Tighten pitman arm to specifications.
Squawk noise in steering gear when turning or recovering from a turn.	Dampener "O" ring on gear valve spool cut or hardened.	Replace dampener "O" ring.
Chirp noise in steering pump. Belt squeal (Particularly noticeable at full wheel travel and stand still parking). Growl noise in steering pump.	Loose belt. Loose belt. Excessive back pressure in hoses or steering gear caused by restriction.	Adjust belt tension to specification. Adjust belt tension to specification. Locate restriction and correct. Replace part if necessary.
Growl noise in steering pump (Particularly noticeable at standstill parking).	Scored pressure plates, thrust plate or rotor. Extreme wear of cam ring.	Replace parts, disassemble gear and clean. Flush hoses. Replace parts, disassemble gear and clean. Flush Hoses.
Groan noise in steering pump.	Low fluid level. Air in the fluid. Poor pressure hose connection.	Fill reservoir to proper level. Tighten connector to specified torque. Bleed system by operating steering from right to left -- full turn.

BACK TO INDEX

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STEERING GEAR AND PUMP DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Rattle noise in steering pump.	Vanes not installed properly.	Install properly.
	Vanes sticking in rotor slots.	Free up by removing burrs, varnish or dirt.
Swish noise in steering pump.	Malfunctioning flow control valve.	Replace part.
Whine noise in steering pump.	Pump shaft bearing scored.	Replace housing and shaft. Disassemble gear and clean. Flush hoses.
Poor return of steering wheel to center.	Lack of lubrication in linkage and spherical joints.	Lube linkage and spherical joints. Check seals for damage and replace if necessary.
	Lower coupling flange rubbing against steering gear adjuster plug.	Loosen pinch bolt and assemble properly.
	Steering gear to column misalignment.	Align steering column.
	Tires not properly inflated.	Adjust to specified pressure.
	Improper front wheel alignment.	Check and adjust as necessary.
		With front wheels still on alignment pads of front-end machine, disconnect pitman arm of linkage from pitman shaft of gear. Turn front wheels by hand. If wheels will not turn or turn with considerable effort, determine if linkage or spherical joints are binding.
	Steering linkage binding.	Replace pivots.
	Spherical joints binding.	Replace spherical joints.
	(Turn steering wheel and listen for internal rubbing in column - check causes listed and correct as directed.)	
	Steering wheel rubbing against directional signal housing.	Adjust steering jacket.
	Tight or frozen steering shaft bearings.	Replace bearings.
	Rubber spacer binding in shift tube.	Make certain spacer is properly seated. Lubricate inside diameter with silicone.
	Sticky or plugged spool valve.	Remove and clean or replace valve.
	Steering gear adjustments over specifications.	Check adjustment with gear out of vehicle. Adjust as required.
	Tight or frozen U-joint in steering shaft – Eldorado only.	Replace U-joint.
(Keep in mind road condition and wind. Test car on flat road going in both directions)	Front end misaligned. Radial tire lateral force (conicity)	Adjust to specifications. (Usually excess cross-caster) Rotate tires to equalize conicity force (see section 10).
	Unbalanced steering gear valve.	
	(NOTE: If this is cause, steering effort will be very light in direction of lead and heavy in opposite direction.)	Replace valve.

BACK TO INDEX

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STEERING GEAR AND PUMP DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Momentary increase in effort when turning wheel fast to right or left.	Low fluid level in pump. Pump belt slipping. High internal leakage. Insufficient pump flow to gear.	Add power steering fluid as required. Tighten or replace belt. Check pump pressure. (See pump pressure test). Replace discharge fitting, check for restriction in hose or gear inlet.
Steering wheel surges or jerks when turning with engine running especially during parking.	Low fluid level. Loose pump belt. Steering linkage hitting engine oil pan at full turn. Insufficient pump pressure. Sticky flow control valve.	Fill as required. Adjust tension to specification. Correct clearance. Check pump pressure. (See pump pressure test). Replace relief valve if necessary. Inspect for varnish or damage, replace if necessary.
Excessive wheel kickback or loose steering.	Air in system. Steering gear loose on frame. Steering gear flexible coupling loose on shaft or rubber disc mounting screws loose. Steering linkage joints worn enough to be loose. Front wheel bearings incorrectly adjusted or worn. Worn poppet valve (Gear). Loose thrust bearing preload adjustment. (Gear) Excessive "over-center" lash.	Add power steering fluid to pump reservoir and bleed by operating steering. Check hose connectors for proper torque and adjust as required. Tighten attaching screws to specified torque. Tighten flange pinch bolts to specified torque, if serrations are not damaged. Tighten upper flange to coupling nuts to specified torque. Replace loose pivots. Adjust bearings or replace with new parts as necessary. Replace poppet valve. Adjust to specification with gear out of vehicle. Adjust to specification with gear out of vehicle.
Hard steering or lack of assist. (NOTE: If previous checks do not reveal cause of hard steering, follow the procedure below to determine fault.)	Loose pump belt. Low fluid level in reservoir. (NOTE: Low fluid level will also result in excessive pump noise.) Steering gear to column misalignment. Lower coupling flange rubbing against steering gear adjuster plug. Tires not properly inflated. Further possible causes could be: Sticky flow control valve. Insufficient pump pressure output. Excessive internal pump leakage. Excessive internal gear leakage.	Adjust belt tension to specification. Fill to proper level. If excessively low, check all lines and joints for evidence of external leakage. Tighten loose connectors to specified torque. Align steering column. Loosen pinch bolt and assemble properly. Inflate to recommended pressure. In order to diagnose conditions listed below, a test of the entire power steering system is required.

BACK TO INDEX

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STEERING GEAR AND PUMP DIAGNOSIS CHART (Cont'd.)

CONDITION	CAUSE	CORRECTION
Foaming milky power steering fluid, low fluid level, and possible low pressure.	Air in the fluid, and loss of fluid due to internal pump leakage causing overflow.	Check for leak and correct. Bleed system. Extremely cold temperatures will cause system aeration should the oil level be low. If oil level is correct and pump still foams, remove pump from vehicle and separate reservoir from housing. Check welsh plug and housing for cracks. If plug is loose or housing is cracked, replace housing.
Low pressure due to steering pump.	Flow control valve stuck or inoperative.	Remove burrs or dirt or replace.
	Pressure plate not flat against cam ring.	Correct.
	Extreme wear of cam ring.	Replace parts. Disassemble gear and clean. Flush hoses.
	Scored pressure plate, thrust plate or rotor.	Replace parts (If rotor, replace with rotating group kit), disassemble gear and clean.
	Vanes not installed properly.	Install properly.
	Vanes sticking in rotor slots.	Free-up by removing burrs, varnish or dirt.
	Cracked or broken thrust or pressure plate.	Replace part.
Low pressure due to steering gear.	Pressure loss in cylinder due to worn piston ring or scored housing bore.	Remove gear from car for disassembly and inspection of ring and housing bore.
	Leakage at valve rings, valve body to worm seal.	Remove gear from car for disassembly and replace seals.

BACK TO INDEX

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STEERING LINKAGE DIAGNOSIS CHART

CONDITION	CAUSE	CORRECTION
Excessive play or looseness in steering system.	Front wheel bearings loosely adjusted.	Adjust bearings or replace with new parts as necessary.
	Worn couplings or steering shaft U-joints.	Replace.
	Worn upper spherical joints.	Replace.
	Steering wheel loose on shaft, loose pitman arm, tie rods, steering arms or steering linkage ball studs.	Tighten to specified torque.
	Steering gear worm bearings loosely adjusted.	Adjust preload to specification.
	Excessive pitman shaft or ball nut lash in steering gear.	Adjust preload(s) to specification.
	Worn intermediate rod or tie rod sockets.	Replace worn parts.
	Shock absorber soft (Eldorado only).	Replace shock absorber.
Excessive looseness in tie rod or intermediate rod pivots, or excessive vertical lash in idler support.	Seal damage and leakage resulting in loss of lubricant, corrosion and excessive wear.	Replace damaged or worn parts as necessary.
Hard Steering--Excessive effort required at steering wheel.	Low or uneven tire pressure.	Adjust to specified pressures.
	Steering linkage or spherical joints need lubrication.	Lube with specified lubricant. Check for damaged seal.
	Tight or frozen intermediate rod, tie rod or idler socket.	Lube or replace as necessary. Check for damaged seal.
	Steering gear to column misalignment.	Align column.
	Steering gear adjusted too tightly.	Adjust preload to specification.
	Front wheel alignment incorrect.	Check alignment and correct as necessary.
	Shock absorber bound up (Eldorado only).	Replace shock absorber.
Poor returnability.	Steering linkage or spherical joints need lubrication.	Lube with specified lubricant.
	Steering gear adjusted too tightly.	Adjust preload to specifications.
	Front wheel alignment incorrect.	Check alignment and correct as necessary.
	Steering gear to column misalignment.	Align column.

BACK TO INDEX

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STANDARD COLUMN DIAGNOSIS CHART

CONDITION	CAUSE	CORRECTION
Will not unlock.	Sector collapsed. Lock bolt damaged. Damaged lock cylinder. Damaged housing.	Replace sector shaft. Replace lock bolt. Replace lock cylinder. Replace housing.
Will not lock.	Lock bolt spring broken or damaged. Damaged sector tooth. Damaged lock cylinder. Burr on lock bolt or housing. Damaged housing. Transmission linkage adjustment incorrect. Sector installed incorrectly.	Replace lock bolt spring. Replace sector. Replace lock cylinder. Remove burr. Replace housing. Readjust. Install correctly.
High effort.	Lock cylinder damaged. Ignition switch damaged. Rack preload spring broken or deformed. Burrs on sector, rack or housing. Bent sector shaft. Actuator rod restricted.	Replace lock cylinder. Replace ignition switch. Replace rack preload spring. Remove burr. Replace housing assembly. Remove restriction.
High effort on lock cylinder between "off" and "off-lock".	Burr on tang of shift gate. Distorted rack.	Remove burr. Replace rack.
Will stick in "start".	Actuator rod deformed. Any high effort condition. Ignition switch damaged.	Straighten or replace. Check items under high effort section. Replace switch.
Lock bolt hits shaft lock in "off" position and "park".	Ignition switch is not set correctly.	Readjust ignition switch.
Key cannot be removed in "off-lock".	Ignition switch is not set correctly. Damaged lock cylinder.	Readjust. Replace lock cylinder.
Lock cylinder can be removed without depressing retainer.	Lock cylinder with damaged retainer. Lock cylinder without retainer. Burr over retainer slot in housing.	Replace lock cylinder. Replace lock cylinder. Remove burr in housing.

BACK TO INDEX

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STANDARD COLUMN DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	CORRECTION
	IGNITION SYSTEM	
Electrical system will not function.	Blown fuse in "Accessory" circuit.	Replace fuse.
	Connector body loose or damaged.	Tighten or replace.
	Broken wiring.	Repair or replace.
	Damaged ignition switch.	Replace ignition switch.
Switch will not actuate mechanically.	Damaged ignition switch.	Replace ignition switch. NOTE: Follow installation procedure outlined on label attached to column.
Switch cannot be set correctly.	Switch actuator rod deformed.	Repair or replace switch actuator rod.
Noise in column.	Coupling bolts not tightened.	Tighten pinch bolts to specified torque.
		Tighten coupling bolts to specified torque. (Parts should be inspected for damage before reassembling. If serrations or threads are damaged, replace parts).
	Coupling pulled apart.	Realign column and replace coupling.
		Broken shaft plastic injected joint. If shaft is damaged, replace -- if not, repair joint using steering shaft repair kit.
	Horn contact ring not lubricated.	Lubricate with lubriplate or equivalent.
	Lack of grease on bearings or bearing surface.	Lubricate.
	Lower shaft bearing tight or frozen.	Replace bearing. Check shaft and replace if scored.
	Upper shaft bearing tight or frozen.	Replace housing assembly.
	Shaft lock plate cover loose.	Tighten three screws to specified torque or, if missing, replace. *CAUTION: Use specified screws only.*
	Lock plate retaining ring not seated.	Replace retaining ring. Check for proper seating in groove.
	Shaft lock plate cover loose.	Tighten three screws.

Method to Determine Column Collapse

Measure distance between top of neutral-start switch window opening and the bottom of the upper jacket. The correct dimension is 5 11/16" - 5 1/2".

BACK TO INDEX

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STANDARD COLUMN DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	CORRECTION
One click when in "off-lock" position and the steering wheel is moved.		None - normal -- lock bolt is seating.
High steering shaft turning effort.	Column assembly misaligned in vehicle. Improperly installed or deformed dust seal. Tight or frozen upper or lower bearings. U-Joint binding (Eldorado only)	Align correctly. Replace dust seal. Replace. Replace U-Joint
High shift effort.	Column not aligned correctly in car. Lower bowl bearing not assembled correctly. Improperly installed dust seal. Lack of grease on seal or bearing areas.	Realign Reassemble correctly. Remove and replace. Lubricate.
Improper transmission shifting.	Sheared shift tube joint. Improper transmission linkage adjustment. Improper gate plate.	Replace shift tube assembly. Readjust. Replace with correct part.
Miscellaneous.	Shroud loose on shift bowl. Housing loose on jacket -- will be noticed with ignition in "off-lock" and a torque applied to the steering wheel.	Bend tabs on shroud over lugs on bowl. Tighten four mounting screws to specified torque.
Lash in mounted column assembly.	IP to dash mounting bolts loose. Broken weld nuts on jacket. IP bracket capsule sheared. IP to jacket mounting bolts loose.	Tighten to specified torque. Replace jacket assembly. Replace bracket assembly. Tighten to specified torque.

BACK TO INDEX

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TILT AND TELESCOPING COLUMN DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Will not unlock.	Shear flange on sector shaft collapsed.	Replace sector.
	Lock bolt damaged.	Replace lock bolt.
	Damaged lock cylinder.	Replace lock cylinder.
	Damaged housing.	Replace housing.
	Damaged sector.	Replace sector.
	Damaged rack.	Replace rack.
Will not lock.	Lock bolt spring broken or damaged.	Replace lock bolt spring.
	Damaged sector tooth.	Replace sector.
	Damaged lock cylinder.	Replace lock cylinder.
	Burr on lock bolt or housing.	Remove burr.
	Damaged housing.	Replace housing.
	Transmission linkage adjustment incorrect.	Readjust.
	Damaged rack.	Replace rack.
	Interference between bowl and rack coupling.	Replace bowl or actuator rod as required.
	Ignition switch stuck.	Replace ignition switch.
	Actuator rod restricted.	Readjust.
High effort.	Lock cylinder faulty.	Replace lock cylinder.
	Ignition switch faulty.	Replace ignition switch.
	Rack preload spring broken or deformed.	Replace preload spring.
	Burrs on sector, rack, housing, support or actuator rod coupling.	Remove burr.
	Bent sector shaft.	Replace shaft.
	Faulty rack.	Replace rack.
	Extreme misalignment of housing to cover.	Replace either or both.
	Distorted coupling slot in rack.	Replace rack.
	Bent actuator rod.	Straighten or replace.
	Ignition switch mounting bracket bent.	Straighten or replace.
Will stick in "start".	Actuator rod deformed.	Straighten or replace.
	Any high effort condition.	Check items under high effort section.
	Ignition switch faulty.	Replace switch.

BACK TO INDEX

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TILT AND TELESCOPING COLUMN DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	CORRECTION
Key cannot be removed in "off-lock".	Ignition switch is not adjusted correctly.	Readjust
	Faulty lock cylinder.	Replace lock cylinder.
Lock cylinder can be removed without depressing retainer.	Lock cylinder with broken retainer.	Replace lock cylinder.
	Lock cylinder without retainer.	Replace lock cylinder.
	Burr over retainer slot in housing cover.	Remove burr.
	IGNITION SYSTEM	
Electrical system will not function.	Poor battery connection.	Connect securely.
	Connector body loose or broken.	Tighten or replace.
	Broken wiring.	Repair or replace.
	Faulty ignition switch.	Replace ignition switch.
	Ignition switch not adjusted properly.	Readjust.
Switch will not actuate mechanically.	Faulty ignition switch.	Replace.
Switch cannot be set correctly.	Switch actuator rod deformed.	Repair or replace.
	Sector to rack engaged in wrong tooth.	Engage correctly.
	COLUMN	
Noise in column.	Coupling bolts not tightened.	Tighten pinch bolts to specified torque.
	Column not correctly aligned.	Realign column.
	Coupling pulled apart.	Realign column and replace coupling.
	Broken steering shaft plastic injected joint.	Repair joint using steering shaft repair kit and realign column.
	Horn contact ring not lubricated.	Lubricate with lubriplate or equivalent.
	Lack of grease on bearings or bearing surfaces.	Lubricate
	Loose tilt lever opening shields.	Bend to eliminate rattle.
	Lower shaft bearing worn or broken.	Replace bearing.
		Check shaft and replace if scored.
	Upper shaft bearing worn or broken.	Replace bearing assembly.
	One click when in "off-lock" position and the steering wheel is moved.	Normal -- lock bolt is seating.

BACK TO INDEX

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TILT AND TELESCOPING COLUMN DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	CORRECTION
High steering shaft effort.	Column assembly misaligned.	Realign.
	Improperly installed or deformed dust seal.	Install new seal.
	Faulty upper or lower bearing.	Replace.
	Flashing on I.D. of shift tube from plastic joint.	Replace shift tube.
	Tight Steering universal joint (Eldorado only.)	Repair or replace.
High shift effort.	Column not aligned correctly in car.	Realign.
	Wave washer with burrs.	Replace.
	Improperly installed dust seal.	Remove and replace.
	Lack of grease on seal or bearing.	Lubricate.
	Improper screws used for ignition switch, neutral start switch or mounting bracket.	Use correct fasteners.
	Burr on upper or lower end of shift tube.	Remove burr.
Improper transmission shifting.	Sheared shift tube joint or lower shift lever weld.	Replace tube assembly.
	Improper transmission linkage adjustment.	Readjust.
Miscellaneous.	Housing loose on jacket -- will be noticed with ignition in "off-lock" and a torque applied to the steering wheel.	Tighten four mounting screws to specified torque.
Lash in mounted column assembly.	IP to dash mounting bolts loose.	Tighten to specified torque.
	Broken weld nuts on jacket.	Replace jacket assembly.
	IP bracket capsule sheared.	Replace bracket assembly.
	Loose shoes in housing.	Replace shoes.
	Loose tilt head pivot pins.	Replace pivot pins.
	Loose shoe lock pin in support.	Replace pin.
	Loose support screws.	Tighten to specified torque.
Housing scraping on bowl.	Bowl bent or not concentric with hub.	Replace bowl.

BACK TO INDEX

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TILT AND TELESCOPING COLUMN DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	CORRECTION
Steering wheel loose.	Wheel loose on shaft. Broken or missing anti-lash spring in spheres. Upper bearing not seating in bearing race. Upper bearing inner race seat missing. Improperly adjust T & T locking lever. Loose support screws. Bearing preload spring missing or broken.	Tighten nut to specified torque. Add spring or replace both. Replace both. Install seat. Readjust. Tighten to specified torque. Replace preload spring.
Steering wheel loose -- every other tilt position.	Loose fit between shoe and shoe pivot pin.	Replace both.
Steering column not locking in any tilt position.	Shoe seized on its pivot pin. Shoe grooves may have burrs or dirt. Shoe lock spring weak or broken.	Replace both. Replace shoe. Replace lock spring.
Steering wheel fails to return to top tilt position.	Pivot pins are bound up. Wheel tilt spring is broken. Turn signal switch wires too tight.	Replace pivot pins. Replace tilt spring. Readjust.
Noise when tilting column.	Upper tilt bumpers worn. Tilt spring rubbing in housing.	Replace housing assembly. Lubricate.

Method to Determine Column Collapse

Measure distance between top of neutral-start switch window opening and the bottom of the upper jacket. The correct dimension is 5 11/16" - 5 1/2".

BACK TO INDEX

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TURN SIGNAL SWITCH DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Turn signal will not cancel.	Loose switch mounting screws. Switch or anchor bosses broken. Broken, missing or out of position detent, return or cancelling spring. Uneven or incorrect cancelling cam to cancelling spring interference.	Tighten to specified torque. Replace switch. Reposition or replace spring as required. Adjust switch position: If interference is correct and switch will still not cancel, replace switch. If interference cannot be corrected by switch adjustment, replace cancelling cam.
Turn signal difficult to operate.	Actuator rod loose. Yoke broken or distorted. Loose or misplaced springs. Foreign parts and/or material. Switch mounted loosely.	Tighten to specified torque. Replace switch. Reposition or replace springs. Remove foreign parts and/or material. Tighten mounting screws to specified torque.
Turn signal will not indicate lane change.	Broken lane change pressure pad or spring hanger. Broken, missing or misplaced lane change spring. Jammed base or wires.	Replace switch. Replace or reposition as required. Loosen mounting screws, reposition base or wires and retighten screws to specified torque.
Turn signal will not stay in turn position.	Foreign material or loose parts impeding movement of yoke. Broken or missing detent or cancelling spring. None of the above.	Remove material and/or parts. Replace spring. Replace switch.
Hazard switch cannot be turned off.	Foreign material between hazard support cancelling leg and yoke.	Remove foreign material. No foreign material impeding function of hazard switch -- replace turn signal switch.
Hazard switch will not stay on or difficult to turn off.	Loose switch mounting screws. Interference with other components. Foreign material. None of the above. Actuating lever not installed properly.	Tighten mounting screws to specified torque. Remove interference. Remove foreign material. Replace switch. Reinstall switch and lever assembly.

BACK TO INDEX

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TURN SIGNAL SWITCH DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	CORRECTION
No turn signal lights.	Blown fuse.	Replace fuse.
	Inoperative turn signal flasher.	Replace turn signal flasher. (Note: There are two flashers in the system.)
	Loose chassis to column connector.	Connect securely.
	Disconnect column to chassis connector. Connect new switch to chassis and operate switch by hand.	
	If vehicle lights now operate normally, signal switch is inoperative.	Replace signal switch.
	If vehicle lights do not operate, check chassis wiring for opens, grounds, etc.	Repair chassis wiring as required using manual as guide.
Turn indicator lights on, but not flashing.	Inoperative turn flasher.	Replace turn flasher. (Note: There are two flashers in system.)
	Loose chassis to column connection.	Connect securely.
	Inoperative turn signal switch.	Replace turn signal switch.
	To determine if turn signal switch is inoperative, substitute new switch into circuit and operate switch by hand.	
	If the vehicle's lights operate normally, signal switch is inoperative.	Replace signal switch.
	If the vehicle's lights do not operate, check light sockets for high resistance connections, the chassis wiring for opens, grounds, etc.	Repair chassis wiring as required using manual as guide.
Front or rear turn signal lights not flashing.	Burned out fuse.	Replace fuse.
	Burned out or damaged turn signal bulb.	Replace bulb.
	High resistance connection to ground at bulb socket.	Remove or repair connection.
	Loose chassis to column connector.	Connect securely.
	Disconnect column to chassis connector. Connect new switch into system and operate switch by hand.	
	If turn signal lights are now on and flash, turn signal switch is inoperative.	Replace turn signal switch.
	If vehicle lights do not operate, check chassis wiring harness to light sockets for opens, grounds, etc.	Repair chassis wiring as required using manual as guide.
Stop light not on when turn indicated.	Burned out fuse.	Replace fuse.
	Loose column to chassis connection.	Connect securely.
	Disconnect column to chassis connector. Connect new switch into system and operate switch by hand.	

BACK TO INDEX

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TURN SIGNAL SWITCH DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	CORRECTION
	If brake lights work with switch in the turn position, signal switch is malfunctioning.	Replace signal switch.
	If brake lights do not work, check connector to stop light, circuits, for grounds, open, etc.	Repair connector to stop light circuits using manual as guide.
Turn indicator panel lights not flashing.	Burned out bulbs.	Replace bulbs.
	High resistance to ground at bulb socket.	Replace socket.
	Opens, grounds in wiring harness from front turn signal bulb socket to indicator lights.	Locate and repair as required. Use shop manual as guide.
Turn signal lights flash very slowly.	Inoperative turn signal flasher.	Replace turn signal flasher.
	System charging voltage low.	Increase voltage to specified. Use manual.
	High resistance ground at light sockets.	Repair high resistance grounds at light sockets.
	Loose chassis to column connection.	Connect securely.
	Disconnect column to chassis connector. Connect new switch into system and Operate switch by hand.	
	If flashing occurs at normal rate, the signal switch is malfunctioning.	Replace signal switch.
Turn signal lights flash very slowly. (Cont'd.)	If the flashing rate is still extremely slow, check chassis wiring harness from the connector to light sockets for grounds, high resistance points, etc.	Locate and repair as required. Use manual as guide.
Hazard signal lights will not flash -- turn signal functions normally.	Blown fuse.	Replace fuse.
	Inoperative hazard warning flasher.	Replace hazard warning flasher.
	Loose chassis to column connection.	Connect securely.
	Disconnect column to chassis connector. Connect new switch into system without removing old.	
	Depress the hazard warning button and observe the hazard warning lights. If they now work normally, the turn signal switch is malfunctioning.	Replace the turn signal switch.
	If the lights do not flash, check wiring harness for open between hazard flasher and harmonica connector. If open, fuse block is inoperative.	Replace fuse block.

BACK TO INDEX

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KEY BUZZER DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Buzzer does not sound with key fully inserted in lock cylinder with the driver's door open.	Inoperative buzzer.	Replace buzzer.
	Bad connection at buzzer.	Connect securely.
	Power not available to buzzer.	Check continuity of chassis wiring and repair as required.
	Horn relay inoperative.	Check by grounding #4 terminal on horn relay, if buzzer does not sound, replace horn relay.
	Door jamb switch on driver's side misadjusted or inoperative.	Adjust or replace as required.
	Short in chassis wiring.	Check by separating chassis to column connector. Connect (black) and (black w/pink stripe) female contacts on the chassis side. A bent paper clip will work. If buzzer sounds, continue diagnosis. If not, locate and repair chassis wiring.

(Note 1: If the buzzer fault has not yet been detected, connect a continuity meter (light) to the male "E & F" connector contacts of the turn signal switch connector (Fig. 9-84). Insert the key the full depth into the lock cylinder.)

If contact is made with the key in, and is not made with it out, the function is normal. Retrace initial diagnostic steps.

If contact is not established, the fault is in the column. Proceed to Note 2.

(Note 2: With the fault isolated in the column, disassemble the upper end of the column until the signal switch mounting screws have been removed. Lift the switch and check the probes of the buzzer switch to insure good contact with the pads on the signal switch. Bend probes, if required, then reseat the signal switch and install the three screws. Check the function, as in Note 1.)

CONDITION	POSSIBLE CAUSE	CORRECTION
Buzzer does not sound, cont'd.	Short or fault in signal switch wiring.	Check wiring by connecting continuity meter on "E" terminal of connector and turn signal switch, buzzer switch pad with black wire attached and "F" terminal to pad with pink wire attached. If contact is made, function is normal. If not, replace signal switch.

(Note 3: If the buzzer has not yet been isolated and repaired, connect a continuity meter to the buzzer switch electrical contact probes. Fully insert and remove the key from the lock cylinder.)

If contact is made with the key in, and is broken with it out, the function is normal. Retrace diagnostic steps starting at Note 2.

If contact is not made, the fault is in the lock cylinder or buzzer switch.

BACK TO INDEX

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KEY BUZZER DIAGNOSIS CHART (Cont'd.)

CONDITION	POSSIBLE CAUSE	CORRECTION
Buzzer does not sound cont'd.	Chips, burrs, foreign material preventing actuator tip function. *CAUTION: Key must be removed or cylinder in "run" position before removing lock cylinder.*	Remove chips, burrs, etc. Reassemble and re-check, see note 3.
	Sticking lock cylinder.	With the lock cylinder out (observing caution above), fully insert and remove the key. The actuator should extend and retract smoothly.
	Chips, foreign material affecting buzzer switch operation.	Remove and clean as required. Reassemble and re-check, see note 3.
	Damaged or broken buzzer switch.	Replace buzzer switch.
	Switch appears good but will not make contact.	Connect continuity meter leads to the buzzer switch probes, Fig. 9-84. Press on the actuator pad until the interior points contact. If contact is not made, replace buzzer switch.
	Buzzer switch contact gap too large.	Reset contact gap.

(Note 4: Setting the contact gap, (Fig. 9-84). Press a .030 wire type spark plug gage with flat piece of stock on the actuator pad.)

If contact is not made adjust switch as shown until positive contact is made. (Use continuity meter).

With positive contact at .030, use a .025 plug gage wire beneath the flat stock. No contact should occur. Adjust as shown in (Fig. 9-84). When the switch will make contact with the .030 wire, and not with the .025, the buzzer switch is set at the low point.

CONDITION	POSSIBLE CAUSE	CORRECTION
Buzzer continues to operate with key in the lock cylinder with the driver's door either opened or closed and ceases when key is removed.	Door jamb switch on driver's side misadjusted or inoperative.	Adjust or replace as required.
	Wire from signal switch to door jamb switch shorted.	If on signal switch side, replace signal switch.
		If on chassis side, find and repair as outlined in manual.

(Note 5: This condition indicates the lock cylinder or buzzer switch is at fault. To verify, check for continuity at the "E" & "F" male connector contacts with the key removed from the lock cylinder, (Fig. 9-84). If continuity exists, the fault is in the column.)

CONDITION	POSSIBLE CAUSE	CORRECTION
Buzzer continues to operate with key out, but stops when driver's door is closed.	Turn lock towards start position. If buzzer stops in "Run" position or when turned past "Run" towards "Start" the problem is a sticky lock cylinder actuator.	Replace lock cylinder.
	Chips, foreign material in lock cylinder bore.	Remove, reassemble and recheck function.
	Sticky lock cylinder actuator tip.	Replace lock cylinder.
	Damaged or broken buzzer switch.	Replace buzzer switch.
	Buzzer switch contact gap too close.	Adjust as specified.

BACK TO INDEX

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SERVICE INFORMATION

The following caution applies to one or more steps in the assembly procedure of components in this portion of the manual as indicated at appropriate locations by the terminology *See CAUTION on page 9-27.*

CAUTION: This fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

1. Checking Fluid Level

When making a complete fluid change, always use special power steering fluid available from servicing parts warehouses. When topping off the fluid (4 ounces or less), if the special fluid is not available, Dexron ®-II Automatic Transmission Fluid or equivalent may be used.

CAUTION: Power steering fluid and brake fluid cannot be mixed. If brake seals contact steering fluid or steering seals contact brake fluid, seal damage will result.

1. Run engine and turn gear from lock to lock three or four times, then shut engine off with gear in left turn position. Remove reservoir filler cap and check oil level on dipstick. Level should be halfway between "hot" and "cold" marks when fluid is approximately 150 degrees (70° celsius) (reservoir is hot to touch).

2. If oil level when hot (approximately 150°) (70° celsius) is below "cold" mark add special power steering fluid until level is halfway between the "hot" and "cold" marks on dipstick and reinstall filler cap.

(NOTE: At room temperature (approximately 70°) (21° celsius) or before starting the engine, the fluid level should be between the "cold" and "add" marks on the dipstick. After high speed driving under high ambient conditions, fluid will be at the "hot" mark at approximately 250° (121° celsius) fluid temperature.)

3. When checking fluid level after making a complete fluid change, air must be bled from the system. Proceed as follows:

a. Install fluid in system. Fluid level in the pump must be at base of reservoir neck.

b. Raise front of car and with engine off, turn wheels all the way to the left.

c. Add power steering fluid to "Add" mark on dipstick.

d. Crank engine for one second or less without starting engine.

e. Add fluid if necessary to "Add" mark on dipstick.

f. Start engine and recheck fluid level. Add fluid if necessary to "Add" mark on dipstick.

g. Bleed system by turning wheels from side to side without hitting stops. Maintain fluid level just above internal pump casting. Fluid with air in it will have a light tan appearance. This air must be eliminated from fluid before normal steering action can be obtained. On hydraulic brake booster equipped cars, depress the brake pedal several times to clear air from the booster.

h. Return wheels to center position and continue to run engine for two or three minutes, then shut engine off.

i. Road test car to make sure steering functions normally and is free from noise.

j. Recheck fluid level as described in step 1 making sure fluid is at the specified level.

2. Checking Pump Pressure

1. Disconnect pressure hose at union of pump, use a small container to catch any fluid which might leak.

2. Connect a spare pressure hose to pump union. A 1969 or 1970 hose may be more convenient than current production.

3. Using pressure gage, J-5176-1, adapter fitting, J-22326, connect gage to both hoses.

4. Open hand valve on gage.

5. Start engine, allow system to reach operating temperatures and check fluid level adding any fluid if required. When engine is at normal operating temperature, the initial pressure read on the gage (valve open) should be in the 80-125 PSI range. Should this pressure be in excess of 200 PSI, check the hoses for restrictions and the poppet valve for proper assembly.

6. Close gate valve fully three times. Record the highest pressures attained each time.

CAUTION: Do not leave valve fully closed for more than five seconds as the pump could be damaged internally.

7. If the pressures recorded are between 1425 - 1475 PSI and the range of readings are within 30 PSI, the pump is functioning within specifications.

8. If the pressures recorded are high, but do not repeat within 30 psi, the flow controlling valve is sticking. Remove the valve, clean it and remove any burrs using crocus cloth or fine hone. If the system contains some dirt, flush it. If it is exceptionally dirty, both the pump and the gear must be completely disassembled, cleaned and reassembled before further usage.

9. If the pressures recorded are constant, but below the low listed specification, replace the flow control valve and recheck. If the pressures are still low, replace the rotating group.

10. If the pump checks to specification, leave the valve open and turn (or have turned) the steering wheel into both corners. Record the highest pressures and compare with the maximum pump pressure recorded. If this pressure cannot be built in either (or one) side of the gear, and is below specification, the gear is leaking internally and must be disassembled and repaired.

11. Shut off engine, remove testing gage, spare hose, reconnect pressure hose, check fluid level or make needed repairs. Run engine and recheck fluid level as outlined in Note 1.

BACK TO INDEX

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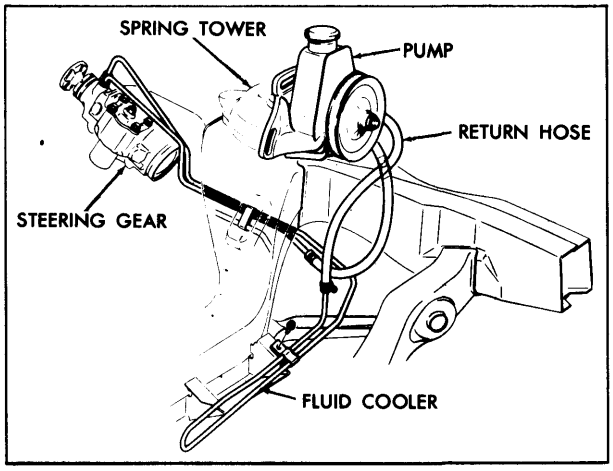


Fig. 9-18 Steering Pump Fluid Cooler Location

3. Steering Pump Fluid Cooler Tube (Fig. 9-18)

a. Removal

1. Position container under fluid cooler to catch fluid that will escape when hose and clamp are removed.
2. Remove clamp securing return hose to fluid cooler tube and position hose to prevent further leakage of fluid.
3. Separate return line from gear and plug opening at gear to prevent loss of fluid and entrance of dirt into system.
4. Remove screws and clips securing cooler tube to frame center bracket and underside of frame cross member.

(NOTE: Eldorado cooler is secured to the bottom of the cradle support.)

b. Installation

1. Position new cooler tube, remove plug in gear and connect new cooler. Tighten nut finger tight.
2. Secure cooler to frame center bracket and underside of frame cross member. (Eldorado is fastened to bottom of cradle support.) Tighten mounting screws to 11 foot-pounds.
3. Tighten nut to gear to 30 foot-pounds.
4. Install hose on return line and on longest end of "Trombone" and secure each end with clamp, tighten to 20 inch-pounds.
5. Bleed and refill steering system with power steering fluid, following procedure of Note 1.

4. Steering Linkage Parallelism — Except Eldorado (Fig. 9-19)

Drag link height and parallelism should be checked in cases of steering wander and instability after normal correcting adjustments such as standing height, front wheel alignment, etc., have been made. Check drag link height by measuring distance between lower edge of drag link, just inboard of tie rod inner pivots, and centerline of lower control arm inner pivot bolts. The procedure outlined below may be used to measure these distances:

1. Position car on wheel alignment machine and place a straight edge midway between drag link and lower control arm front inner pivots across a level parallel surface, see Fig. 9-19.

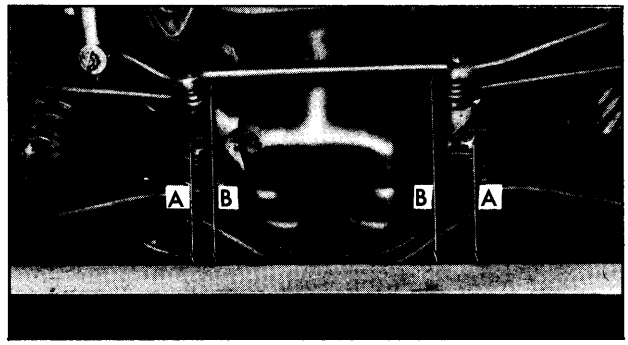


Fig. 9-19 Steering Linkage Parallelism (Except Eldorado)

2. Measure distance "A" from centerline of control arm pivots to top of straight edge.
3. Measure distance "B" from drag link (just inboard of inner pivots) to top of straight edge.
4. Distance "A" minus distance "B" should be equal at both inner pivot points within 1/8" for proper parallelism.
5. Vertical adjustment can be made by loosening idler arm support mounting screws on frame side bar and moving arm support to obtain proper height. (Tighten mounting screws to 35 foot-pounds). If additional adjustment is required, loosen steering gear mounting bolts and move gear to obtain proper height. (Tighten steering gear mounting bolts to 55 foot-pounds).

See CAUTION on page 9-27.

6. Additional vertical adjustment can sometimes be obtained by tightening the pitman arm nut to a higher torque. This will move the pitman arm further onto the steering gear splined shaft.

Never loosen pitman arm nut to obtain vertical adjustment.

(NOTE: In no case should either the pitman arm or idler arm be bent to obtain the required adjustment.)

See CAUTION on page 9-27.

5. Steering Column Alignment

(NOTE: Do not raise car on hoist while aligning column as full weight of car must be on wheels for proper alignment.)

1. Start engine and place front wheels in the straight ahead position for easy access to flex-coupling adjustment screws.
2. Remove lower steering column cover as described in Section 12, Note 58.
3. Loosen screw that attaches shift cable to right hand side of column shift bowl to avoid damage to shift pointer while adjusting column.
4. Loosen two bolts that secure upper steering column mounting bracket to upper steering column support.
5. Move carpet seal up and move carpet back. Loosen six screws that secure lower steering column bracket to toe pan and one clamp screw securing lower steering column bracket to column.

BACK TO INDEX

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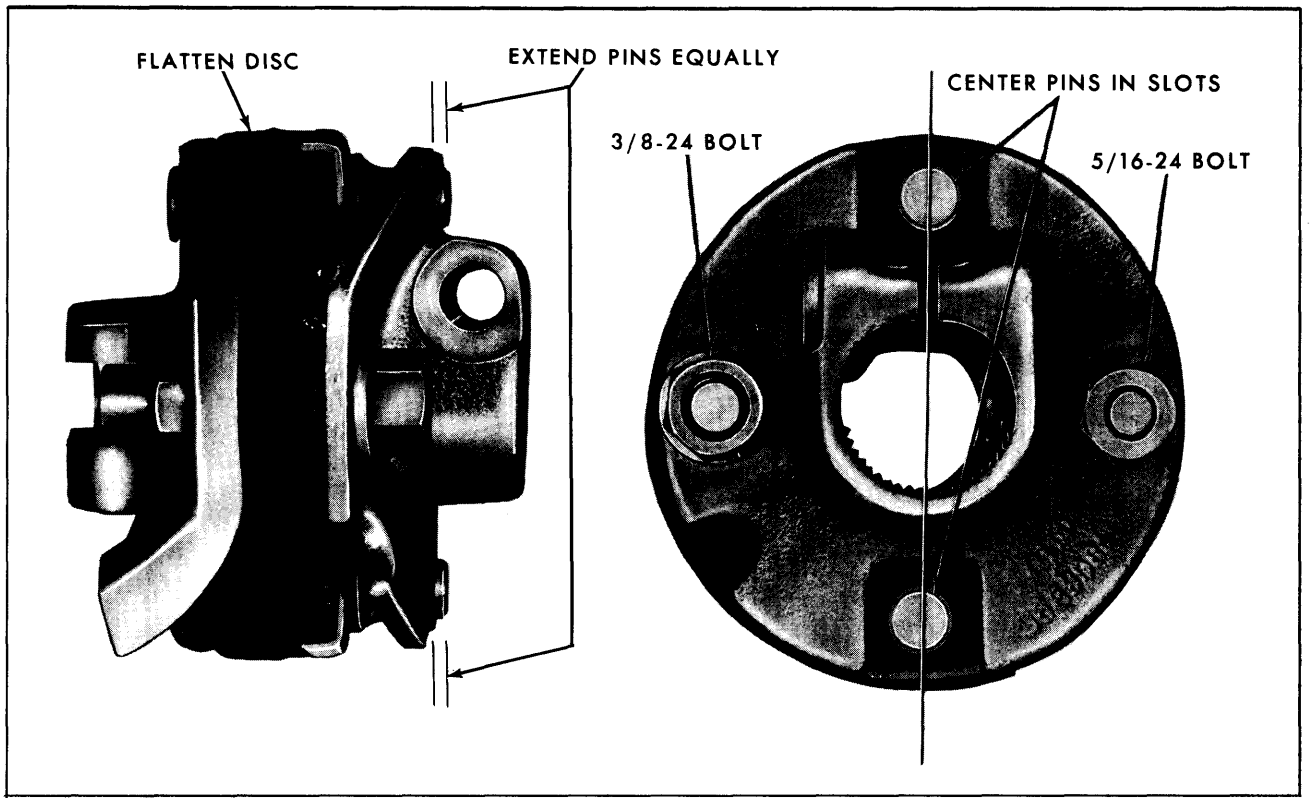


Fig. 9-20 Steering Shaft Flexible Coupling

6. On all cars except Eldorado, loosen one clamp screw that secures steering shaft to flex-coupling clamp. On Eldorado, loosen clamp screw securing steering extension shaft to universal joint clamp.

7. Align the steering column to the instrument panel as follows:

a. Adjust in and out position of column to instrument panel as described below:

Upper edge of column shift bowl (at column centerline) must be the proper distance from instrument panel bezel to have correct steering wheel to driver relationship. If working on standard column, this distance should be 4-7/16", on Tilt and Telescope column, measurement should be 2-1/4".

b. After making the above adjustment, center column within the instrument panel bezel.

Lightly torque two upper mounting brackets to support bolts.

8. Check alignment of flex-coupling disc. The steering column and gear are correctly aligned when the rubber disc is flat and the pins are centered in the "C" slots in the upper flange. The pins should extend beyond the edges of the flange slots equally at both locations, Fig. 9-20. After alignment, tighten clamp screw to 30 foot-pounds.

See CAUTION on page 9-27.

9. Install steering column lower support and make final adjustments as follows:

a. Position lower half of mounting bracket against column and lightly torque two bottommost bracket to toe pan screws.

b. Position upper half of mounting bracket and lightly torque remaining four bracket to toe pan screws.

c. Tighten clamp bolt securing bracket halves to 18 inch-pounds.

d. Start engine and turn steering wheel from stop to stop several times to neutralize position of column.

e. Tighten two upper mounting bracket to support bolts to 20 foot-pounds.

CAUTION: DO NOT exceed 20 foot-pounds as that is the maximum torque the release capsule can withstand and still provide satisfactory release.

f. Tighten all six lower mounting bracket to toe pan screws to 35 inch-pounds.

10. Adjust shift pointer and tighten attaching screw.

11. Install carpet at lower column support and position rubber carpet seal over carpet.

12. Install lower steering column cover as described in Section 12, Note 58, and recheck for proper operation of assembly. If necessary, repeat step 10.

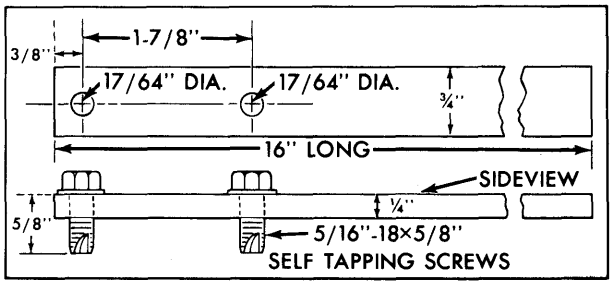


Fig. 9-21 Belt Tensioning Tool

BACK TO INDEX

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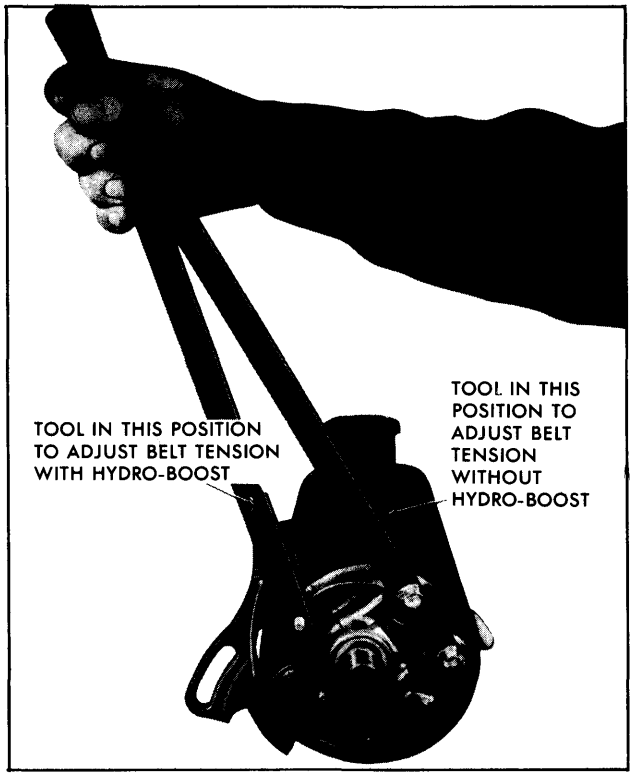


Fig. 9-22 Belt Tensioning Tool Location

13. Check shift linkage for proper operation. Adjust if necessary as outlined in Section 7, Note 3, for all cars except Eldorado and Note 60 for Eldorado cars.

6. Steering Pump

a. Removal

1. Disconnect pressure and return lines from pump and filter inlet. Plug all openings to prevent loss of fluid and entrance of dirt into system.

2. Remove nut securing pump mounting bracket to cylinder head stud.

3. Remove adjusting screw securing mounting bracket to front of cylinder block.

4. Remove drive belts from pulley.

5. Remove buttom pivot screw and steering pump with bracket and filter attached.

b. Installation

1. Position steering pump, with bracket and filter attached, to engine and loosely install bottom pivot screw securing pump and bracket to front of cylinder block.

2. Position drive belts on pulley. Do not tension belts at this time.

3. Loosely install adjusting screw securing mounting bracket to front of cylinder block.

4. Loosely install nut securing pump mounting bracket to cylinder head stud.

5. Adjust belt tension as follows:

a. Place Belt Tension Gage, J-23600, on drive belt midway between pulleys at location B, shown in Section 6, Fig. 6-13.

b. Pull pump toward outside of car until correct belt tension is reached on belt tension gage, using the tool illustrated in Fig. 9-21, which can be made from bar steel stock and self-tapping screws. This tool fits into the accommodating holes in the front face of the pump casting behind the pulley, Fig. 9-22. Do not pull or pry on pump reservoir.

(NOTE: Proper tension for a new belt is 170 lbs., and 120 lbs. for a belt that has been previously tensioned.)

c. Tighten all mounting and adjusting bolts and nut to 22 foot-pounds.

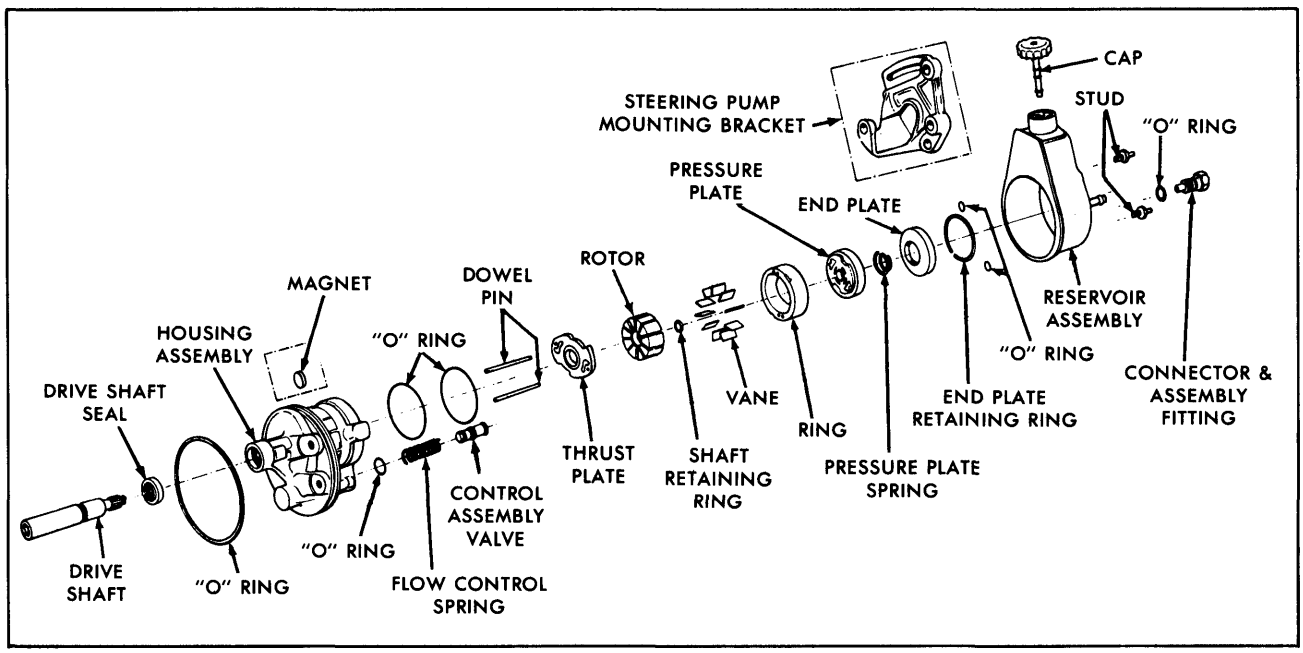


Fig. 9-23 Steering Pump Disassembled

BACK TO INDEX

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6. Unplug fittings and connect high pressure line at rear of pump. Tighten fitting to 40 foot-pounds.

7. Unplug fittings and install return hose(s) on fitting at side of pump and to filter inlet and secure with clamp. Tighten clamp to 20 inch-pounds.

8. If car is equipped with (Hydro-boost), secure filter bracket to face of pump with one screw.

9. Check fluid level as described in Note 1.

10. Bleed steering gear as described in Note 1, Step 3.

7. Steering Pump Disassembly, Cleaning, Inspection, and Assembly

Dissassembly of the major components within the pump must be performed on a clean workbench. The work area, tools, and parts must be kept clean at all times. Refer to Fig. 9-23 for parts nomenclature and location.

a. Disassembly (Fig. 9-23)

1. Remove steering pump and bracket assembly from engine (with filter attached if Hydro-boost).

2. Loosen clamps holding filter to bracket and short hose to return port. Remove and discard filter.

3. Remove clamp holding short hose to return port and remove hose.

4. Remove single bolt holding filter bracket to front face of pump and remove filter bracket.

5. Clamp mounting bracket in vise.

6. Remove steering pump pulley from shaft using J-25034 steering pump pulley remover, Fig. 9-24.

CAUTION: Never remove pulley by pounding it off with a hammer. This could damage pulley as well as snap ring at inner end of the shaft. If pounding pulley inward, pressure plate will be broken; outward, thrust plate will be broken. Complete disassembly of the pump is required for replacement of these parts.

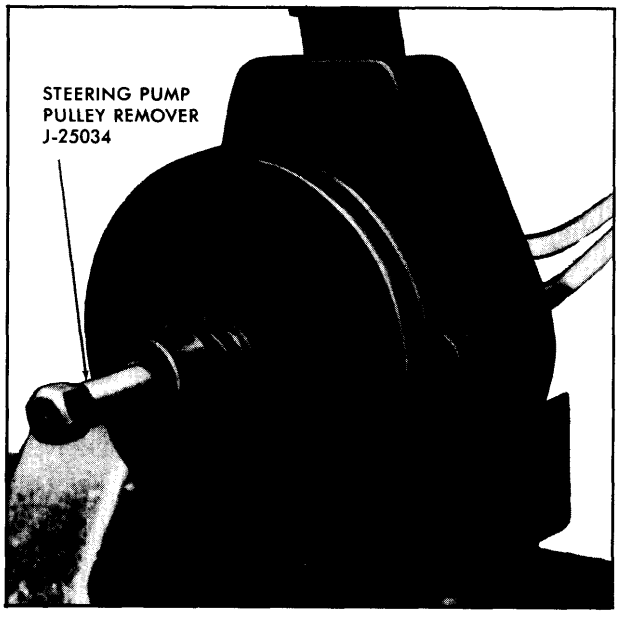


Fig. 9-24 Pulley Remover

7. Remove bracket from pump.

8. Place pump assembly in vise, shaft down, using flat on housing for one clamping surface. Do not exert excessive force, as this may distort bearing.

9. Remove pressure union and O-ring seal from rear of pump assembly. Discard O-ring seal.

CAUTION: Spring loaded flow control valve tends to "pop" out when pressure union is removed.

10. Lift reservoir from pump housing by rocking reservoir up and away from housing.

11. Remove and discard outer pump housing O-ring seal, mounting bolt O-ring seals, and flow control valve opening O-ring seal.

12. Remove magnet from pump housing.

13. Rotate end plate retaining ring so that one end of ring is over hole in housing. Spring one end of ring with punch to allow screwdriver to be inserted to lift ring out, Fig. 9-25.

(NOTE: Hold hand over retaining ring as end plate is spring loaded and may pop-out.)

14. Remove end plate and end plate "O" ring. End plate is spring loaded and will generally raise above the housing, making removal easy. However, if end plate should stick a slight rocking action on top surface will free the plate, Fig. 9-26.

15. Remove pressure plate spring.

16. Remove pump from vise and invert. Flow control valve and spring will fall free, Fig. 9-27. Flow control valve is serviced as a unit and should not be disassembled.

(NOTE: Clean shaft with crocus cloth if necessary to remove rust and corrosion before removing shaft.)

17. Tap very lightly on end of shaft, only until pressure plate falls free, Fig. 9-28.

18. Remove pressure plate, shaft with rotor and vanes, and thrust plate attached.

19. Remove vanes from rotor, then remove retaining ring from splined end of shaft and remove rotor and thrust plate from shaft. Discard retaining ring.

(NOTE: To remove retaining ring, clamp shaft in

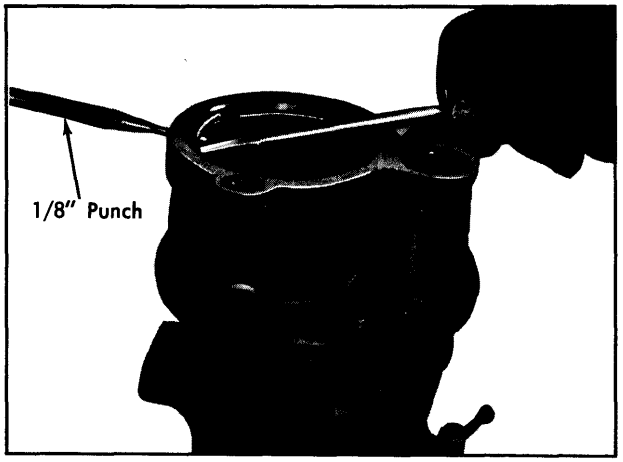


Fig. 9-25 Removing End Plate Retaining Ring

BACK TO INDEX

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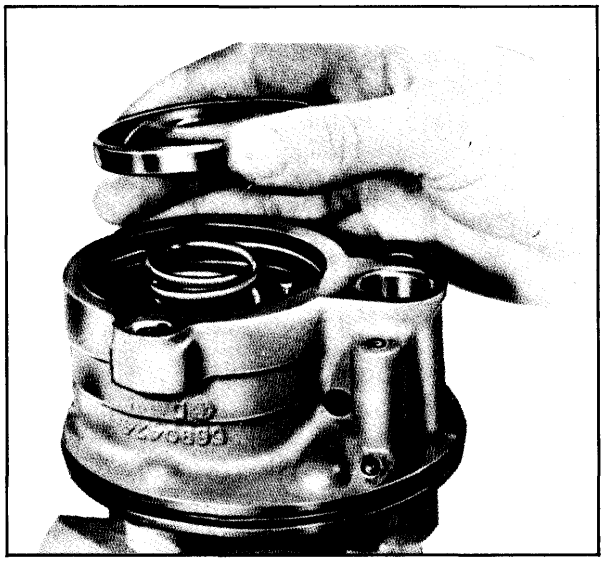


Fig. 9-26 Removal of End Plate Exposing Spring

soft jawed vise, and using a pair of long nose pliers or a screwdriver, pry retaining ring off shaft. Be careful not to damage shaft with vise jaws.)

20. Remove pressure plate O-ring seal and end plate O-ring seal from bore of housing and discard.

21. Remove shaft seal by prying out with screwdriver and discard seal.

(NOTE: Take care not to damage housing bore.)

b. Cleaning and Inspection

Carefully clean all pump parts in non-toxic cleaning solvent. Remove ferrous material adhering to magnet. Replace any damaged or worn parts.

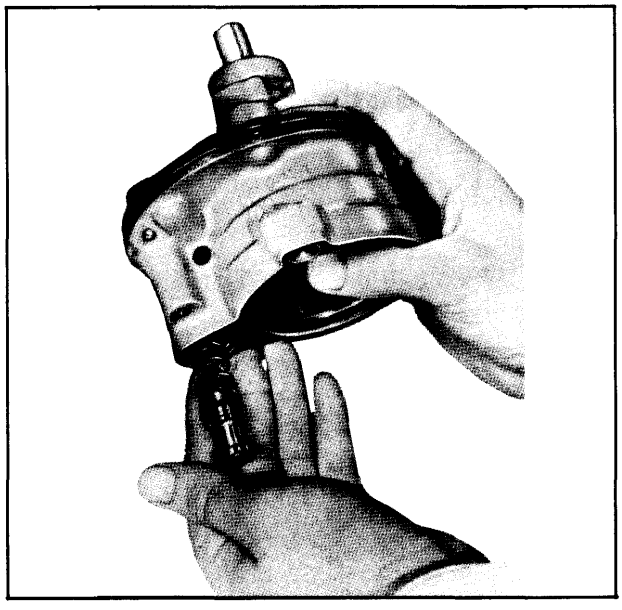


Fig. 9-27 Removal of Flow Control Valve and Spring

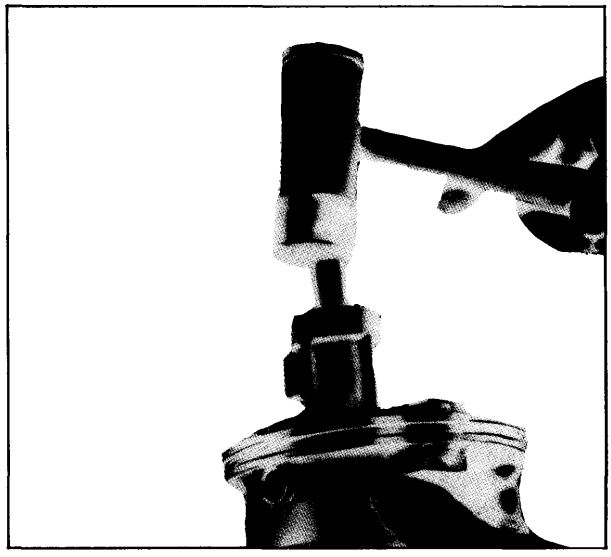


Fig. 9-28 Tapping Shaft to Unseat Pressure Plate

1. Inspect flow control valve assembly for score marks, wear, burrs, or other damage.

2. Inspect castings for cracks or other visual evidence of damage. Check machined surfaces, especially mating surfaces on O-ring seats, for scratches or burrs that might permit leaks. Examine the V-shaped notches at edges of discharge ports on pressure plate. These notches must be clean and undamaged if pump noise is to be avoided, as they cushion the hydraulic shock when each vane passes the port.

3. Inspect cam ring end surfaces for score marks.

(NOTE: Cam ring is specially treated which leaves a dull gray-black finish on wear surface. Wavy grain appearance inside cam ring is normal.)

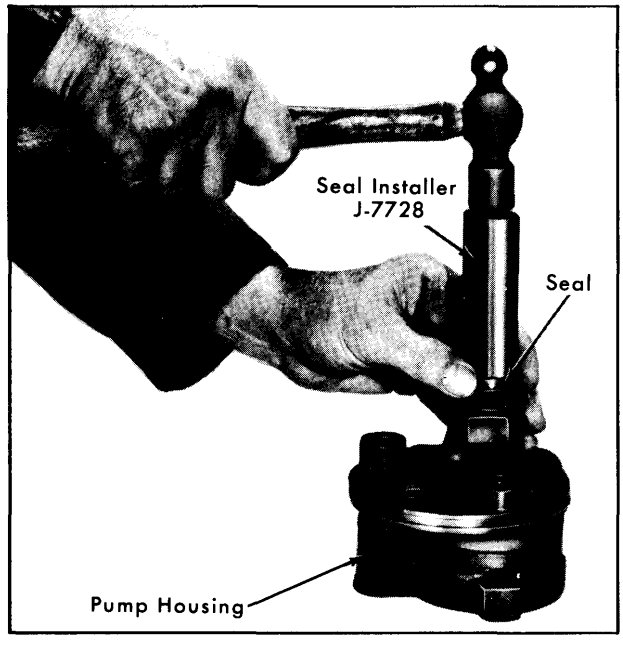


Fig. 9-29 Installing Pump Shaft Seal

BACK TO INDEX

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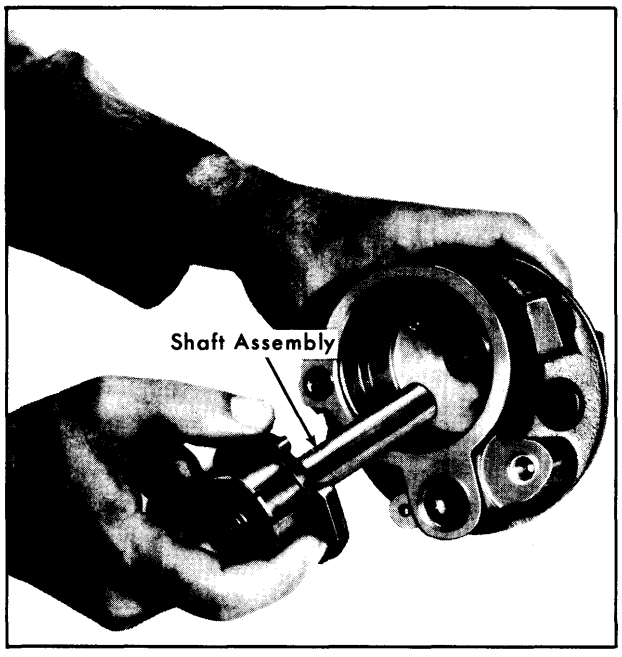


Fig. 9-30 Installing Pump Shaft Assembly

4. Inspect pump shaft for score marks, excessive wear, or damage – particularly at splines and at bearing and seal surfaces. Separate rotor and vanes and inspect for wear and general condition.

5. Inspect shaft bushing in pump housing, and replace pump housing if bushing is scored or excessively worn.

6. If any internal parts are found to be worn or damaged, disassemble gear and clean internal parts.

c. Assembly

1. Lubricate new O-ring seals and seat areas with power steering fluid.

2. Lubricate new shaft seal with power steering fluid and install in housing with metal backing up. Use Seal Installer, J-7728, Fig. 9-29.

3. Install new pressure plate and end plate O-ring seals in proper grooves in pump housing.

4. Install thrust plate on drive shaft with ported face toward splined end of shaft.

5. Install rotor on shaft with counterbored end toward thrust plate.

6. Clamp shaft in soft jawed vise and install new retaining ring on splined end of shaft by prying ring open and sliding it down over shaft until it seats itself in ring groove. Be careful not to damage shaft.

7. Insert drive shaft with thrust plate and rotor into housing. Fig. 9-30. Make sure that shaft is properly seated.

8. Place pump housing in vise, hub down, using flat on hub for one clamping surface.

9. Install dowel pins through thrust plate into pump housing.

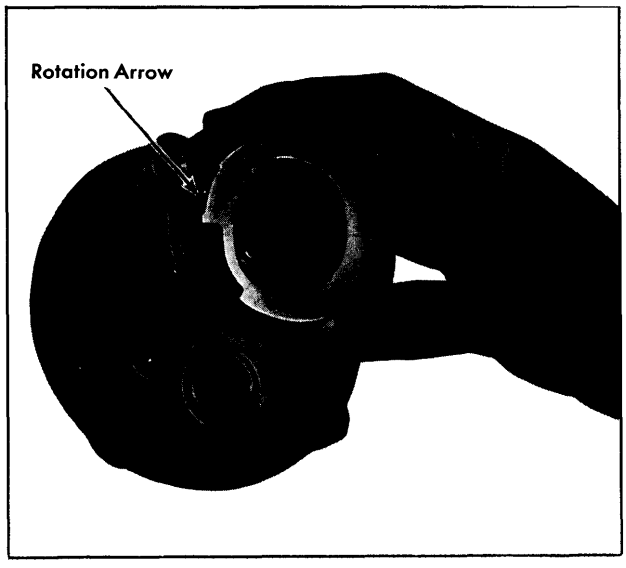


Fig. 9-31 Installing Cam Ring

10. Install cam ring on dowel pins with rotation arrow toward rear of pump housing and pointing in direction of pump rotation, Fig. 9-31. Direction of rotation is counterclockwise when viewed from rear of pump.

11. Install vanes in slots in rotor, with radius edges toward outside of rotor, so they ride on cam ring.

12. Lubricate outside diameter of pressure plate with petrolatum or equivalent to prevent damage to O-ring and install pressure plate on dowel pins with ported face toward cam ring. Install plate so that narrow slots in plate engage dowel pins. Make sure that pressure plate is properly seated by tapping lightly around outer circumference with a wooden hammer handle.

13. Install pressure plate spring.

14. Lubricate outside diameter of end plate with petrolatum or equivalent and install end plate in pump housing.

15. Place pump housing in arbor press, depress end plate below retaining ring groove, and install end plate retaining ring, Fig. 9-32. Make certain that ring is completely seated in groove of housing.

16. Place cleaned magnet flat against pump housing adjacent to pump inlet port, Fig. 9-30.

17. Install new outer pump housing O-ring seal, flow control valve opening O-ring seal, and mounting bolt O-ring seals in pump housing.

18. Install reservoir on pump housing. Do not hammer on housing.

19. Install flow control valve spring.

20. Install flow control valve (hex head screw goes into bore first), Fig. 9-33.

21. Install pressure union using a new O-ring seal in rearmost groove. Tighten to 32 foot-pounds.

22. Install mounting bracket on pump and secure with three screws. Tighten screws to 32 foot-pounds.

23. Clamp mounting bracket in vise with pump attached.

BACK TO INDEX

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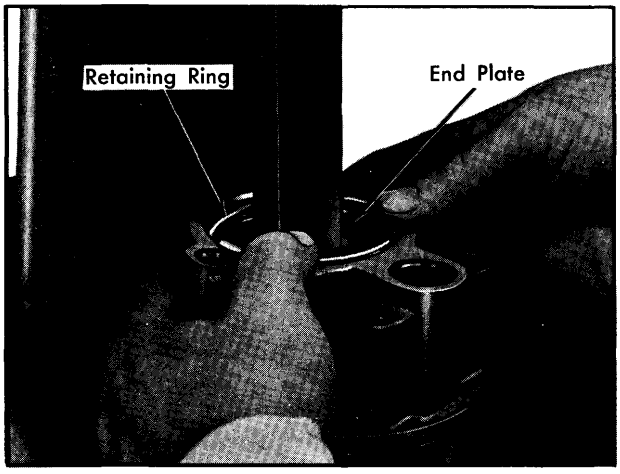


Fig. 9-32 Installing End Plate Retaining Ring

24. Position steering pump pulley on shaft and screw steering pump pulley installer J-25033, Fig. 9-34 into shaft as far as it will go.

25. Make certain that the pulley is started evenly and that the steering pump pulley installer fits flush with the hub of the pulley.

26. Press the pulley onto the shaft until the hub is flush with the end of the shaft Fig. 9-34.

CAUTION: Never install pulley by pounding with a hammer as pressure plate will be broken, and possibly damage snap ring requiring complete disassembly of pump to replace parts.

(NOTE: Large nut on tool has left hand threads.)

27. If car has Hydro-boost, install filter bracket to front face of pump with one bolt. Torque to 30 foot-pounds.

28. Install new filter to pump with short hose and two clamps. Clamp to bracket with large clamp. Note direction of flow crimp end of filter to pump. Torque clamps to 20 inch-pounds.

29. Install pump on car as described in Note 6b.

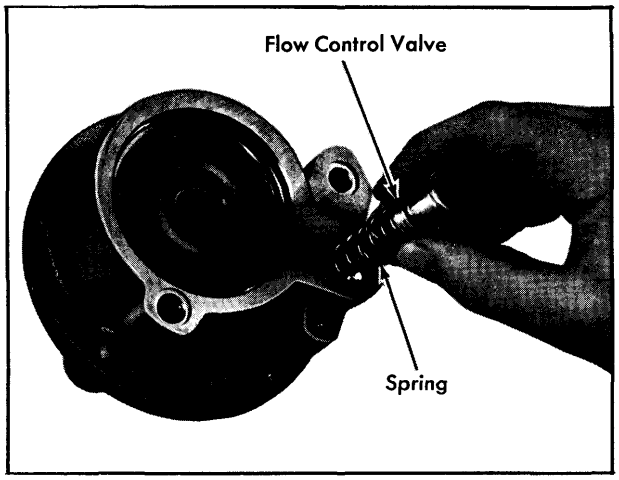


Fig. 9-33 Installing Flow Control Valve

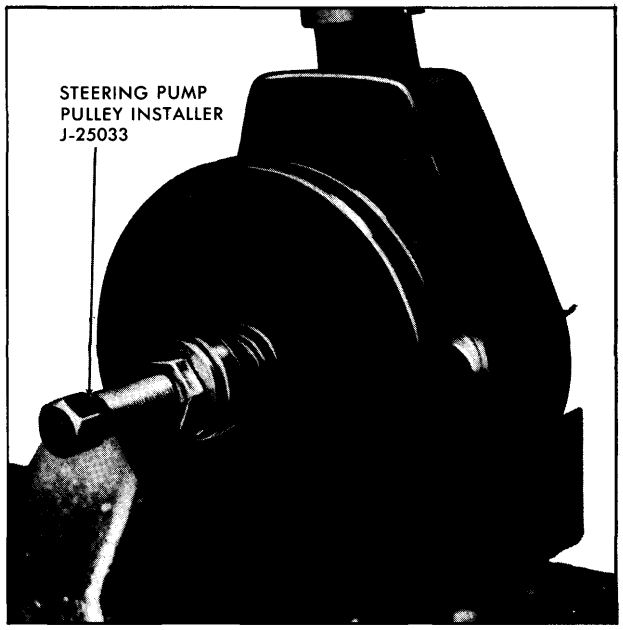


Fig. 9-34 Pulley Installer

8. Steering Pump Shaft Seal Replacement—Off Car

Steering pump shaft seal cannot be replaced with pump on car as there is insufficient clearance for application of tools for removing pulley and installing seal. For replacing seal only, proceed as follows:

1. Remove pump from car as described in Note 6a.

2. Clamp mounting bracket in vise with pump attached and remove pulley from shaft using pulley puller, J-25034, Fig. 9-24.

CAUTION: Never remove pulley by pounding it off with a hammer as this could damage pulley as well as snap ring at inner end of shaft. If pounding pulley outward, thrust plate will be broken, requiring complete disassembly of pump for replacement of parts.

3. Remove shaft seal by prying out with sharp tool.

CAUTION: Insert sharp tool between seal and pump housing. Do not pry against pump shaft.

4. Remove pump and mounting bracket from vise and lay flat on bench, allowing return pipe(s) to hang over side of bench, Fig. 9-35, so it will not be damaged when installing new shaft seal.

CAUTION: Pump mounting bracket may be damaged if clamped in vise while installing new shaft seal.

5. Position new shaft seal on drive shaft with metal backing facing pulley end of shaft.

(NOTE: Clean shaft with crocus cloth if necessary to remove rust and corrosion before removing shaft.)

BACK TO INDEX

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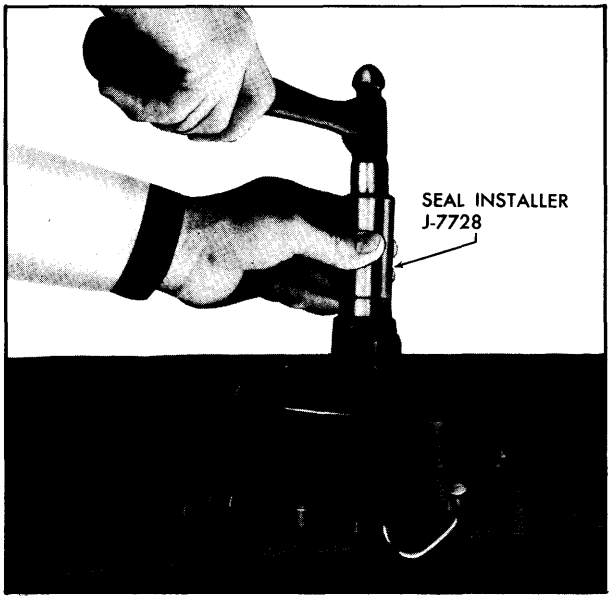


Fig. 9-35 Installing Pump Shaft Seal (Off Car)

6. Install seal, using Pump Shaft Seal Installer, J-7728, Fig. 9-29. Tap tool lightly with small hammer until seal is properly seated in shaft hub.

7. Clamp mounting bracket in vise with pump attached.

8. Position steering pump pulley on shaft and screw steering pump pulley installer J-25033, Fig. 9-34 into shaft as far as it will go.

9. Make certain that the pulley is started evenly and that the steering pump pulley installer fits flush with the hub of the pulley.

10. Press the pulley onto the shaft until the hub is flush with the end of the shaft.

CAUTION: Never install pulley by pounding with a hammer as pressure plate will be broken, and possibly damage snap ring requiring complete disassembly of pump to replace parts.

(NOTE: Large nut on tool has left hand threads.)

11. Install pump on car as described in Note 6b.

9. Steering Gear—Except Eldorado

a. Removal

1. Position container under gear to catch dripping fluid.

2. Disconnect pressure and return lines at steering gear. Plug all openings to prevent loss of fluid and entrance of dirt into system.

3. Remove two nuts and lockwashers that hold the upper half of the flexible coupling to the lower shaft.

4. Raise car.

5. Remove nut and lockwasher, break pitman arm loose from pitman shaft using Pitman Arm Puller, J-9172, and remove pitman arm from steering gear.

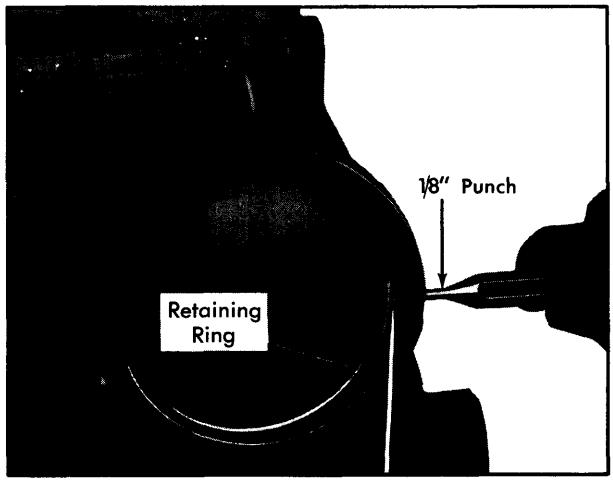


Fig. 9-36 Removing End Cover Retaining Ring

(NOTE: Residual torque on nut after driving may range from 10-200 foot-pounds.)

6. Remove three screws that hold steering gear to frame side rail, lower gear assembly down and out of car.

(NOTE: If mounting threads are stripped, do not repair. Replace housing.)

b. Installation

1. Position steering gear to frame side rail so that flexible coupling bolts engage upper flange.

(NOTE: One bolt is 5/16", the other is 3/8".)

Secure gear to side rail with three mounting screws. Tighten screws to 55 foot-pounds.

See CAUTION on page 9-27.

2. Position pitman arm on pitman shaft and install lockwasher and nut. Tighten nut to 185 foot-pounds to seat arm on shaft.

See CAUTION on page 9-27.

3. Lower car.

4. Unplug openings and connect pressure and return lines to steering gear. Tighten fittings to 30 foot-pounds.

5. Install 5/16" nut and lockwasher, and 3/8" nut and lockwasher to bolts through the flexible coupling. Tighten nuts to 20 foot-pounds.

See CAUTION on page 9-27.

6. Check fluid level and bleed steering system as outlined in Note 1.

10. Steering Gear, Removal of Major Components

1. Position gear assembly in vise with end cover tilted upward about 20°, and clamp lower tab at valve end of gear.

BACK TO INDEX

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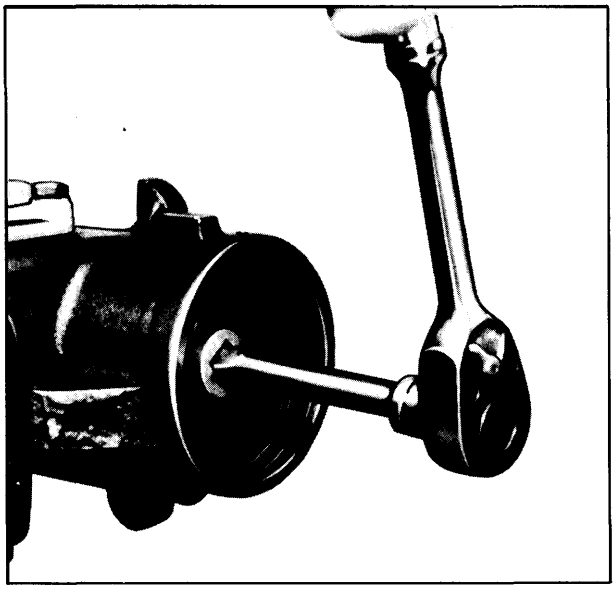


Fig. 9-37 Removing Rack Piston End Plug

2. Rotate gear housing end cover retaining ring so that one end of ring is over hole in housing. Spring one end of ring with punch to allow screwdriver to be inserted to lift ring out, Fig. 9-36.

3. Rotate coupling flange counterclockwise until rack-piston loosens end cover in housing. Remove end cover and O-ring from housing.

CAUTION: Do not rotate any further than necessary or balls with fall out of their circuit and pitman shaft teeth and rack-piston will become disengaged.

4. Remove rack-piston end plug in the following manner.

a. Strike end plug with a plastic mallet to unseat threads.

(NOTE: This is important, as end plug is tightened to 80 foot-pounds during assembly and could break during removal if not handled carefully.)

b. Turn flexible coupling flange until pitman shaft teeth are centered in housing.

c. Use a ratchet and a 1/2 inch square drive extension to remove end plug, Fig. 9-37.

5. Remove four side cover-to-housing retaining screws.

6. Tap end of pitman shaft with a soft mallet and slide pitman shaft out of housing. Remove slowly as oil will drain from the housing.

7. Insert Rack-Piston Arbor, J-21552, into rack-piston against end of worm. Turn coupling flange counterclockwise, while holding tool tightly against worm, to force rack-piston onto arbor. Hold tool and pull rack-piston farther onto tool to prevent end circuit balls from falling out, and remove rack-piston from gear housing, Fig. 9-38. Do not remove Rack-Piston Arbor from rack-piston until ready to remove balls from rack-piston.

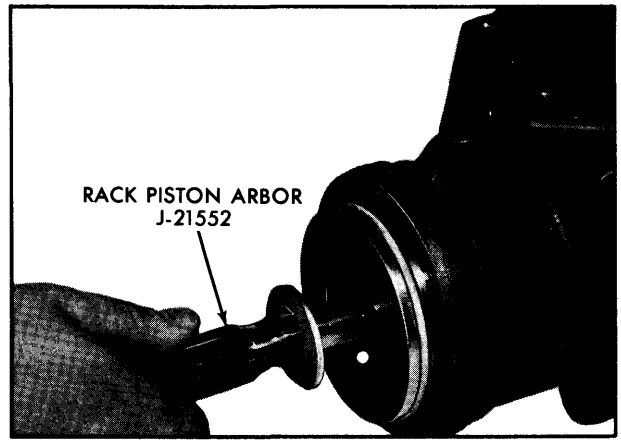


Fig. 9-38 Installing Rack Piston Arbor

(NOTE: On Eldorado steering gears the large snap ring visible at the bottom of the bore is a stop. Do not remove this snap ring.)

8. Remove flexible coupling flange retaining screw and remove coupling flange assembly.

9. Remove adjuster plug locknut by breaking it loose with hammer and punch, and remove locknut from housing.

10. Loosen adjuster plug assembly, using Spanner Wrench J-7624, Fig. 9-39, and remove from housing. Remove and discard adjuster plug O-ring.

11. Remove valve assembly by grasping stub shaft and pulling out. Separate worm and shaft and remove and discard lower shaft cap O-ring.

12. Remove worm, lower thrust bearing, and races from upper end of housing.

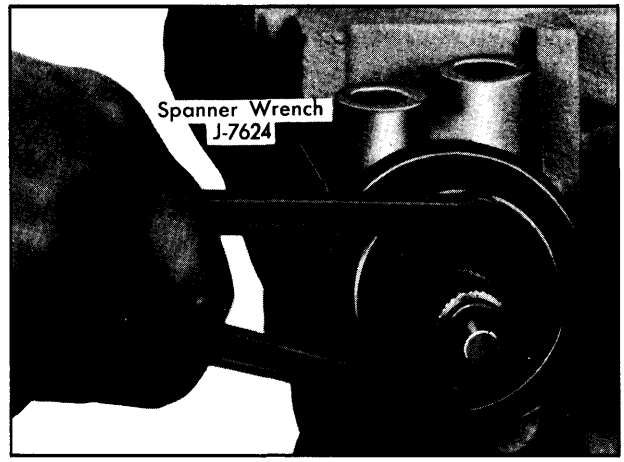


Fig. 9-39 Removing Adjuster Plug

BACK TO INDEX

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11. Steering Gear, Disassembly, Inspection, and Assembly of Major Components

Disassembly of the major components within the gear must be performed on a clean workbench. The work area, tools, and parts must be kept clean at all times. Refer to Fig. 9-41 for parts nomenclature and location.

a. Gear Housing, Pitman Shaft Needle Bearing, and Seals

Disassembly

1. Remove pitman shaft seal retaining ring from gear housing, using Snap Ring Pliers, J-4245 (#3), and, then remove outer back-up washer.

2. Drive needle bearing, outer seal, inner backup washer, and inner seal from gear housing bore with Pitman Shaft Bearing Remover, J-6657. Discard seals.

Inspection

1. Inspect pitman shaft and needle bearing for broken or pitted rollers.

2. Inspect housing bore. If badly scored or worn, replace housing.

(NOTE: Polished surfaces are generally considered acceptable and normal in such cases. The housing should be replaced only if score marks or a wear pattern can be felt with a fingernail. A laser-beam hardening process is used on the bore surface of the steering gear housing to reduce wear. The laser manufacturing process produces longitudinal "tracks", Fig. 9-40, on the inside of the gear housing bore. These tracks are normal and may also leave corresponding polished areas on the rack piston. The tracks and polished areas should not be misdiagnosed as scored on worn surfaces.)

3. Inspect high pressure line hose connector seat in gear housing. If badly scored, replace as described in Note 14. Inspect poppet and seat and replace if deformed or scored.

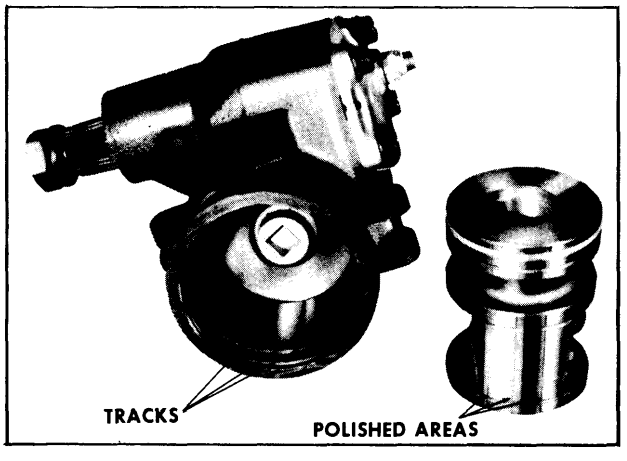


Fig. 9-40 Laser Tracks

4. Inspect low pressure line hose connector seat in gear housing. If badly scored, replace as described in Note 14.

5. Inspect ball plug in valve body end of housing. If it is leaking or raised above the surface, it may be driven in flush or 1/16 inch below surface. Ball can be tightened by staking housing.

6. Inspect all retaining ring grooves and seal surfaces for damage.

Assembly

1. Thoroughly clean the parts and lubricate them with power steering fluid.

2. Install pitman shaft needle bearing on Bearing Installer J-22407, with shoulder on bearing against tool. Position bearing and tool in housing and press bearing into housing, until tool is bottomed out against hub of housing, Fig. 9-42.

3. Lubricate pitman shaft bore and single lip pitman shaft seal with power steering fluid and install seal, lip down, into bore, using Seal Installer, J-6219, Fig. 9-43. Do not drive seal more than 1/8 inch below lip of bore

4. Remove tool and place steel washer on top of seal. Using tool J-6219, drive seal approximately 1/2 inch further into bore.

5. Lubricate double lip seal with power steering fluid and install seal into housing bore. Using Seal Installer, J-6219, drive seal down into bore until top edge of seal is flush with bottom edge of retaining ring groove.

6. Remove tool and place steel washer and retaining ring over seal. Using tool J-6219, drive both seals down into bore until retaining ring falls into retaining ring groove.

(NOTE: In order to avoid possible damage to sealing surface of lower seal, it is important that seals and washers be driven down only far enough so that retaining ring falls into ring groove.)

b. Adjuster Plug Assembly

(NOTE: If replacing oil seal only, install adjuster plug loosely in the gear housing. Remove retaining ring with Snap Ring Pliers, J-4245. Pry out dust seal and oil seal from bore of adjuster plug, being careful not to score the needle bearing bore. To install, follow Steps 2, 3, and 4 under Assembly.)

Disassembly

1. Remove thrust bearing retainer with a screwdriver, Fig. 9-44. Pry alternately on dimples so as not to score needle bearing bore, and discard. Remove thrust bearing spacer, thrust bearing, and thrust bearing races.

2. Remove adjuster plug O-ring seal and discard.

3. Remove stub shaft retaining ring, using Snap Ring Pliers, J-4245 (#3).

4. Remove combination washer and dust seal and discard.

5. Remove stub shaft oil seal by prying out with screwdriver and discard.

BACK TO INDEX

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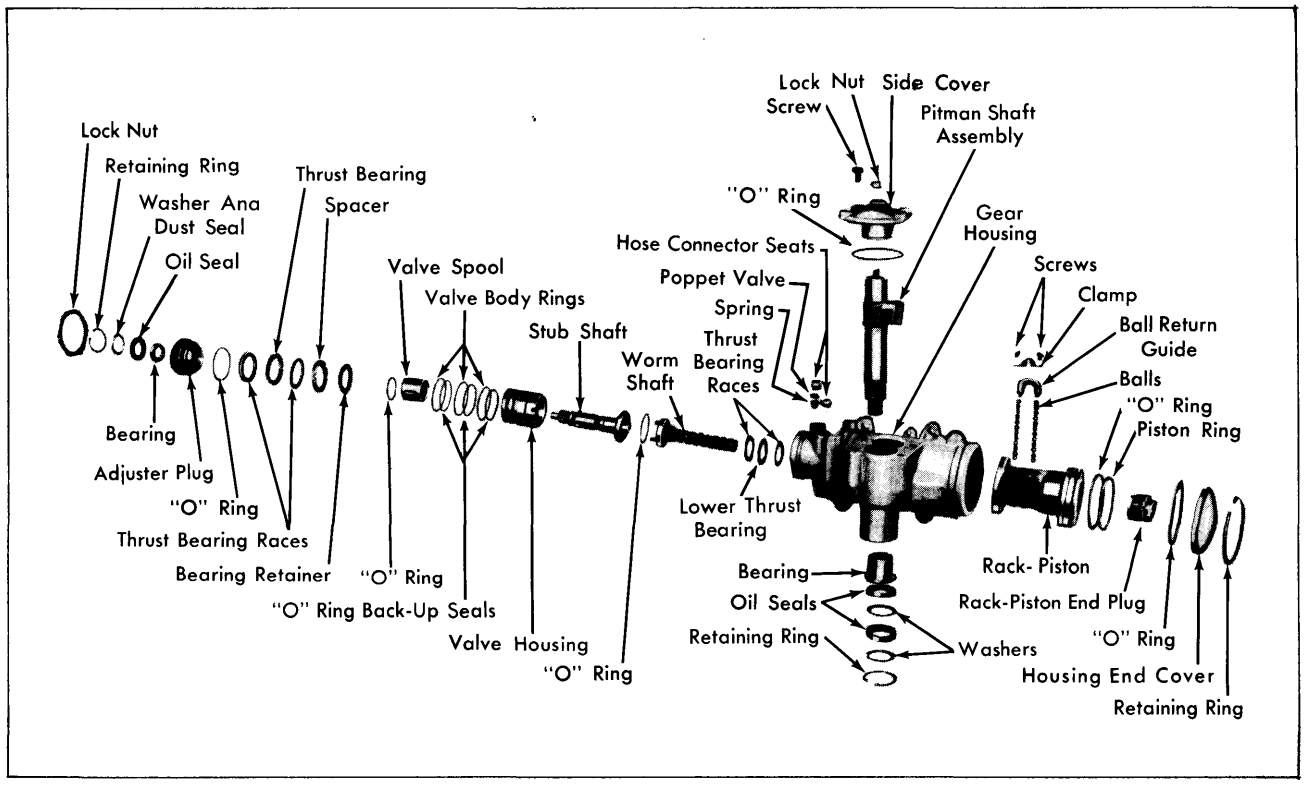


Fig. 9-41 Steering Gear Disassembled

Inspection

1. Inspect needle bearing in adjuster plug. If rollers are broken or pitted, remove needle bearing by pressing out from thrust bearing end, using Adjuster Plug Bearing Remover and Installer, J-6221, Fig. 9-45.
2. Inspect thrust bearing spacer for cracks.
3. Inspect thrust bearing rollers for wear, pitting, scoring, or cracking. If any of these conditions are found, replace bearing and both thrust bearing races.
4. Inspect thrust bearing races for wear, pitting, scoring, cracking, or brinelling. If any of these conditions are found, replace races and check thrust bearing and thrust bearing spacer.

Assembly

1. If adjuster plug needle bearing was previously removed, install new needle bearing on Tool J-6221, with letters on bearings against tool. Position bearing

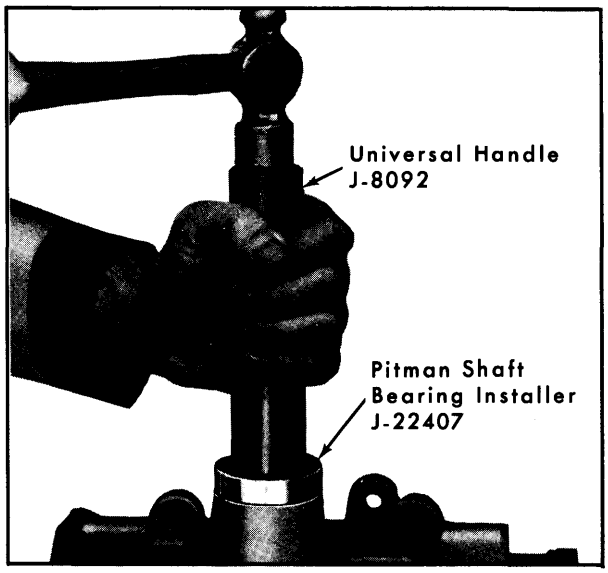


Fig. 9-42 Installing Pitman Shaft Bearing

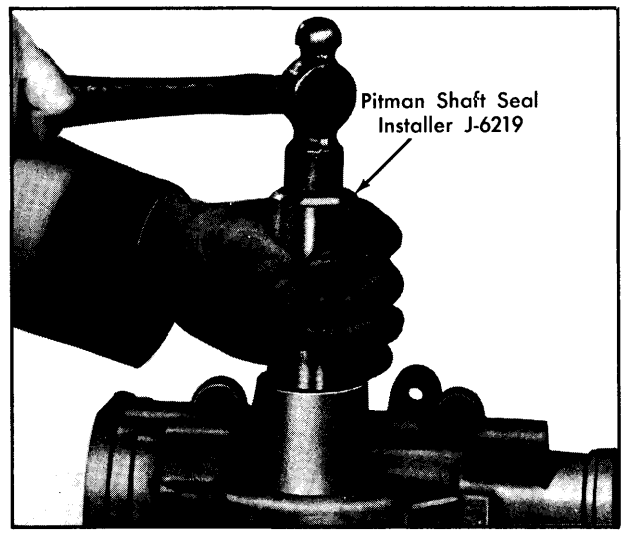


Fig. 9-43 Installing Pitman Shaft Seal

BACK TO INDEX

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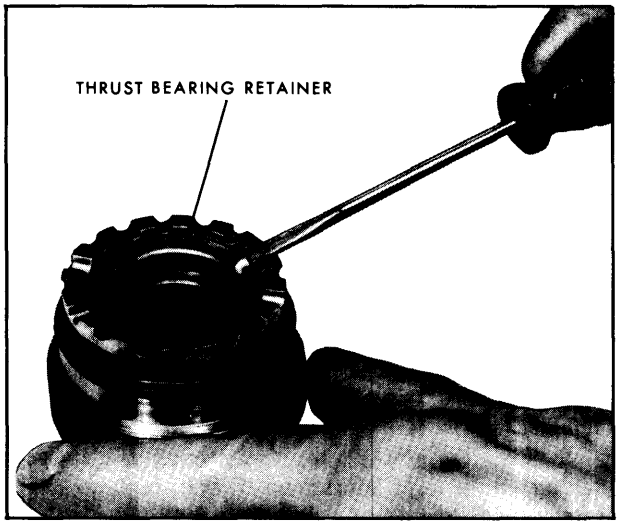


Fig. 9-44 Removing Thrust Bearing Retainer

and tool over thrust bearing end of plug and drive bearing into plug, Fig. 9-45. End of bearing must be flush with bottom surface of stub shaft seal bore.

2. Lubricate new stub shaft oil seal with power steering fluid and, using Adjuster Plug Seal Installer, J-5188, Fig. 9-46, install seal far enough to provide clearance for dust seal and retaining ring.

3. Lubricate new dust seal with power steering fluid and install in plug with rubber face outward.

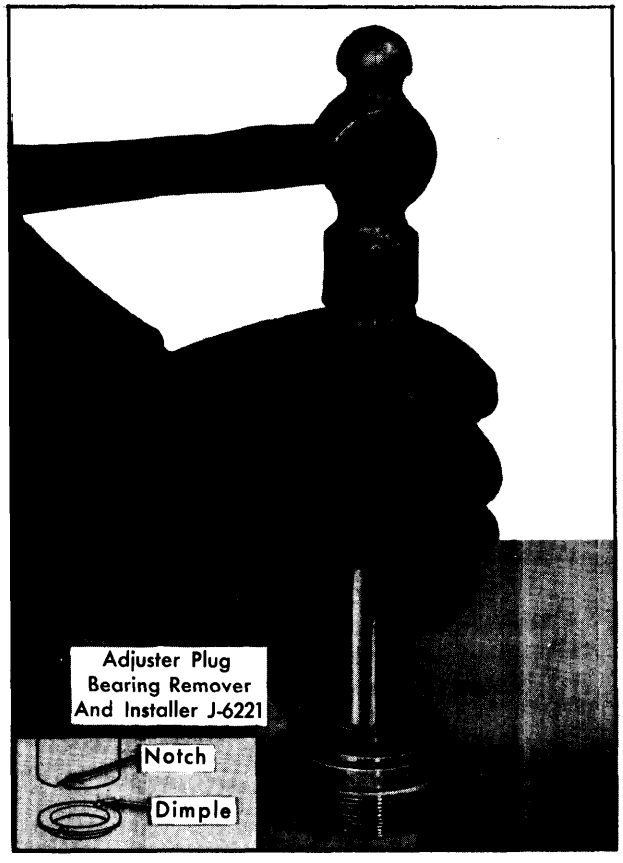


Fig. 9-45 Removing and Installing Adjuster Plug Bearing

4. Install retaining ring with Snap Ring Pliers, J-4245 (#3), making certain that ring is properly seated.

5. Lubricate new O-ring seal with power steering fluid and install in groove on adjuster plug. Assemble flanged thrust bearing race, and thrust bearing, small thrust bearing race, and thrust bearing spacer on adjuster plug. Press bearing retainer into needle bearing bore, using a brass or wooden dowel. Radial location of dimples is not important.

(NOTE: Dowel used to install thrust bearing retainer should be notched to clear retainer dimples. Dimples will distort if used as installation surface.)

c. Stub Shaft and Valve Assembly

The complete valve assembly is a precision unit with selective fitted parts hydraulically balanced during assembly. If replacement of any valve part other than rings or seals is necessary, the complete rotary valve assembly must be replaced.

Do not disassemble valve unless absolutely necessary, to avoid possibility of damage to the assembly. If valve spool dampener O-ring requires replacement, remove valve spool as outlined below, replace O-ring and install spool.

Disassembly

1. Remove cap to worm O-ring seal and discard.

2. Remove stub shaft, torsion bar, and valve cap assembly by holding valve assembly in both hands, with thumbs on valve body. Tap torsion bar lightly against workbench. This will dislodge cap from valve body-to-cap pin. Move the assembly forward far enough for the cap to clear the valve body and disconnect the stub shaft pin from the valve spool. Then remove the stub shaft assembly leaving the spool in the valve body.

CAUTION: Clearance between valve body and spool is .0004-.0006 inch. Slightest cocking of spool may cause it to stick in the valve body.

3. Remove valve spool from valve body by withdrawing spool from the flat end of the valve body with a steady twisting pull to prevent jamming. If slight sticking occurs, carefully work spool back into valve body. If this does not free spool, it has become cocked in the valve body bore. Do not attempt to force the spool in or out if it becomes cocked. Visual inspection on a flat surface will show in which direction spool is cocked. A few very light taps with a light, soft plastic or rawhide mallet should align spool in bore and free it.

CAUTION: Do not tap with anything metallic. If spool can be rotated, it can be removed.

Inspection

1. If there is evidence that torsion bar O-ring seal inside stub shaft has been leaking, entire valve assembly should be replaced.

2. Check pin in valve body that engages cap. If it is severely worn, cracked, or broken, the entire valve assembly should be replaced.

BACK TO INDEX

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Fig. 9-46 Installing Oil Seal

3. Check smaller of the two worm pin grooves in valve body. If it is severely worn, entire valve assembly should be replaced.

4. Check spool drive pin on stub shaft. If it is severely worn, cracked, or broken, entire valve assembly should be replaced.

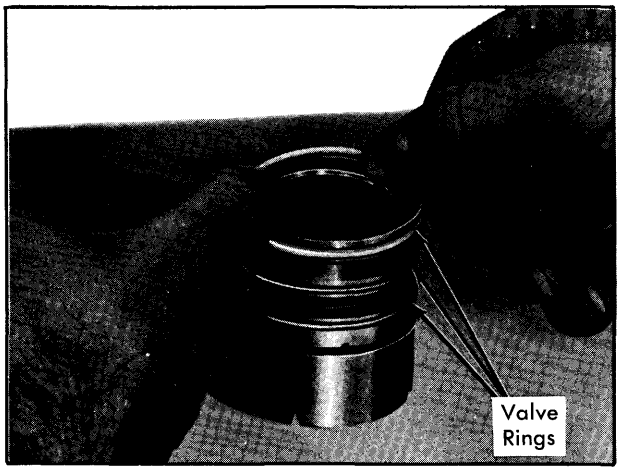


Fig. 9-47 Installing Valve Rings

5. Examine spool O.D. for nicks, burrs, or bad wear spots. If any are found, entire valve assembly should be replaced. A slight polishing is normal on valving surfaces.

6. Examine valve body I.D. for nicks, burrs, or bad wear spots. If any are found, entire valve assembly should be replaced. A slight polishing is normal on valving surfaces.

7. Check fit of spool in valve body before installing valve spool dampener O-ring seal.

When lubricated with power steering fluid, spool should rotate smoothly without binding or catching. If either occurs, entire valve assembly should be replaced.

8. Examine needle bearing diameter of stub shaft. If it is badly worn, or scored, entire valve assembly should be replaced.

9. Visually inspect valve body rings. If damaged, carefully cut valve rings and O-ring back-up seals. Remove and discard.

Assembly

1. If new valve body back-up O-ring seals are necessary, lubricate them with power steering fluid. Assemble in ring grooves on valve body. Do not allow seals to become twisted. If new valve rings are necessary, lubricate them with power steering fluid and assemble valve rings in ring grooves over back-up O-ring seals by carefully slipping rings over valve body, Fig. 9-47. Rings may appear to be loose in grooves, but the heat of the oil after assembly will cause them to tighten.

2. Lubricate new valve spool dampener O-ring seal with power steering fluid and install seal in valve spool groove.

3. Install spool into valve body, Fig. 9-48, sliding it partially through toward notched end.

CAUTION: Because clearance between spool and valve body is .0004-.0006 inch extreme care must be taken when assembling these parts.

4. Insert stub shaft through spool to engage locking pin in spool.

5. Pull spool and stub shaft into valve body aligning stub shaft notch with valve body pin, Fig. 9-49.

6. Lubricate new cap-to-worm O-ring seal with power steering fluid and install in valve body.

(NOTE: Do not install upper thrust bearing assembly on valve assembly at this time.)

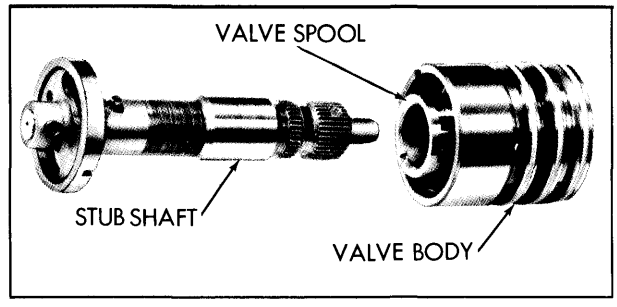


Fig. 9-48 Installing Spool in Body

BACK TO INDEX

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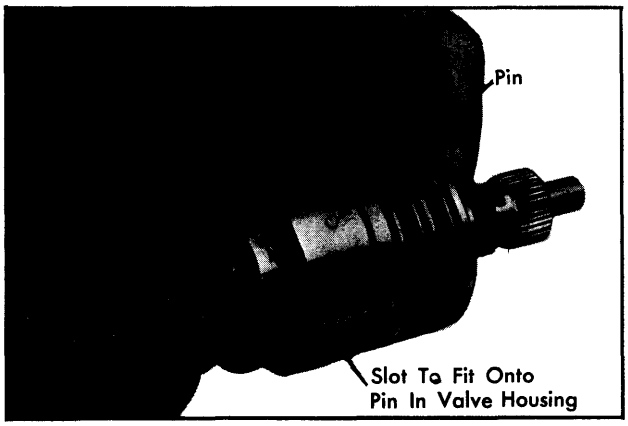


Fig. 9-49 Installing Stub Shaft

d. Pitman Gear Shaft and Side Cover

Inspection

1. Inspect pitman shaft bearing surface in side cover for excessive wear or scoring. If badly worn or scored, replace side cover.

(NOTE: The bearing may extend from the side cover. It is not necessary to reposition the bearing or replace the side cover if this condition occurs.)

2. Visually inspect pitman shaft sector teeth, bearing and seal surface. If abnormally worn, pitted, or scored, replace pitman shaft.

e. Rack-Piston and Worm Assembly

Disassembly

1. Place assembly on a clean cloth. Remove return guide clamp screws and remove clamp.
2. Remove ball return guides and Arbor, J-21552. Make sure all 24 balls are caught on the cloth, (22 balls on constant ratio steering gear used in Limousines, and Commercial Vehicles).

Inspection

1. Inspect worm and rack-piston grooves and all of the balls for excessive wear or scoring. If either worm or rack-piston needs replacing, both must be replaced as a matched assembly.
2. Inspect ball return guides, making sure that the ends where balls enter and leave the guides are not damaged.
3. Inspect lower thrust bearing and races for wear, pitting, scoring, or cracking. If any of these conditions are found, replace thrust bearing and races, and check worm.
4. Inspect rack-piston and end plug to be sure threads are not damaged.
5. Inspect rack-piston teeth for abnormal wear or scoring. Inspect rack-piston O.D. for abnormal wear, scoring, or burrs. If any of these conditions exist and are excessive, both the rack-piston and worm must be replaced.

(NOTE: Polished surfaces are generally considered acceptable and normal in such cases. The housing should be replaced only if score marks or a wear pattern can be felt with a fingernail. A laser-beam hardening process is used on the bore surface of the steering gear housing to reduce wear. The laser manufacturing process produces longitudinal "tracks", Fig. 9-40, on the inside of the gear housing bore. These tracks are normal and may also leave corresponding polished areas on the rack piston. The tracks and polished areas should not be misdiagnosed as scored or worn surfaces.)

6. Visually inspect piston ring; if damaged, remove ring and back-up O-ring seal and discard.

Assembly

1. Thoroughly clean the parts and lubricate them with power steering fluid.
2. Lubricate new back-up O-ring seal, if necessary, with power steering fluid and install in piston ring groove on rack-piston. Do not allow seal to become twisted.
3. Install new piston ring, if necessary, in groove over O-ring seal.
4. Insert worm into end of rack-piston, from end opposite piston ring, until worm is against rack-piston shoulder.
5. Load 17 balls into guide hole nearest piston ring while slowly rotating worm counterclockwise to feed balls through circuit. Alternate black balls with white balls throughout the circuit.

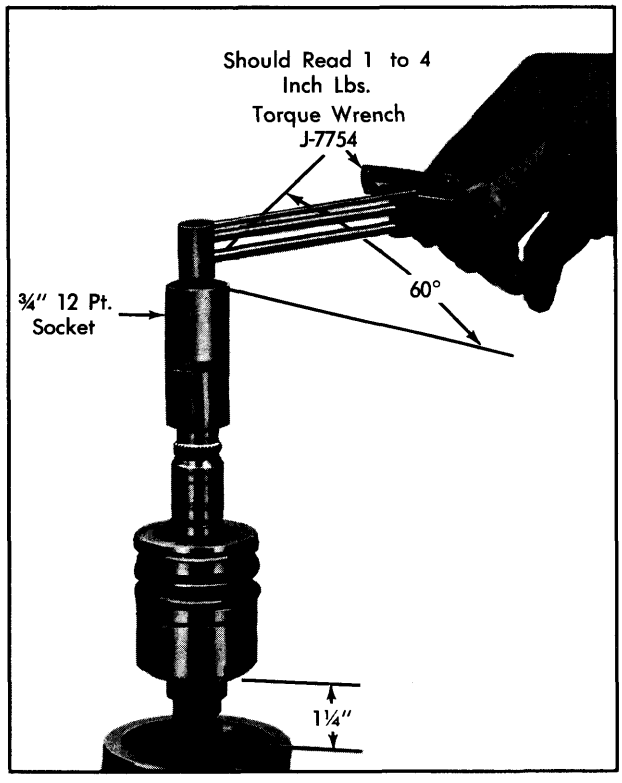


Fig. 9-50 Check Worm and Rack Piston Preload

BACK TO INDEX

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(NOTE: Balls should be measured with a micrometer if mixed or color identification is questioned. The measured difference between the black and white balls is .0005 inch.)

6. Apply a liberal amount of petrolatum or equivalent to one ball return guide and install the remaining balls into guide, 7 balls on variable ratio gear and 5 balls on constant ratio gear. Place the other guide over the balls and ball guide, and insert guides into guide holes of rack-piston. Make sure black ball in guide is installed next to white ball in rack-piston or vice versa. Guides should fit loosely. It is essential that all balls be positioned so that they are alternate in color. No two balls of the same color are to be side by side.

7. Place return guide clamp over guides and secure with two screws and lockwashers. Tighten screws to 10 foot-pounds.

8. Worm groove is ground with a high point in the center. When rack-piston passes over this high point, a preload of 1 to 4 inch-pounds should be obtained. To measure preload of worm and rack-piston ball assembly, proceed as follows:

a. Clamp rack-piston in a bench vise with soft jaws with worm shaft pointing up. Do not distort rack-piston by over-tightening vise.

b. Place valve assembly on worm engaging worm drive pin.

c. Rotate worm until it extends 1-1/4 inches from rack-piston to thrust bearing face. This is center position.

d. Place Torque Wrench, J-7754, with a 3/4 inch 12-point socket on stub shaft, Fig. 9-50, and rotate wrench through an arc of approximately 60° in both directions several times, then take a torque reading. Highest average reading obtained with worm rotating should be between 1 and 4 inch-pounds.

9. If reading is below 1 inch-pound, a new set of balls must be installed upon reassembly. Final preload on replacement balls should be 2 or 3 inch-pounds.

10. Remove valve assembly from worm.

11. Remove rack-piston from vise.

12. Insert Worm Gear Ball Arbor, J-21552, into worm and turn rack-piston onto arbor. Do not allow arbor to separate from worm until rack-piston is fully on arbor.

12. Steering Gear, Installation of Major Components

1. Position gear housing horizontally in vise and clamp lower tab at valve end of gear as shown in Fig. 9-67.

2. Lubricate worm shaft, lower thrust bearing, and races with power steering fluid, then position thrust bearing and races on worm.

(NOTE: Races must be positioned in same direction with cupped side towards worm shaft and curved side towards gear housing.)

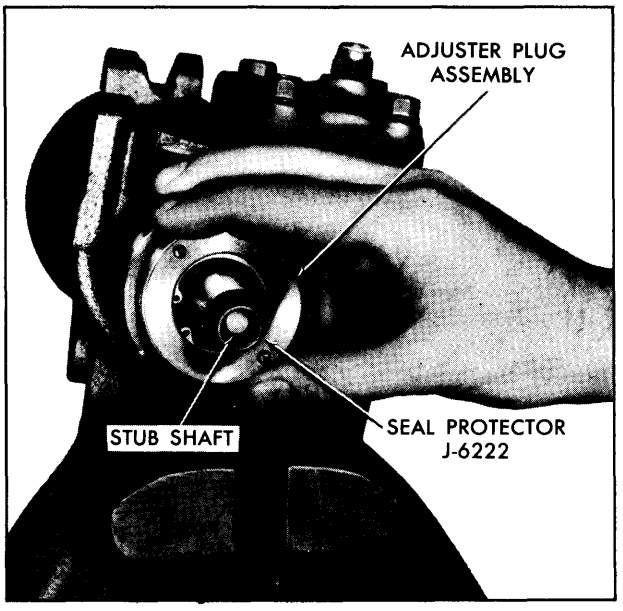


Fig. 9-51 Installing Adjuster Plug

3. Align valve body drive pin on worm with narrow pin slot on valve body. Be sure O-ring seal between valve body and worm head is installed.

4. Position valve assembly and worm shaft in housing as an integral unit.

CAUTION: Do not push against stub shaft, as this might cause stub shaft and cap to pull out of valve body, allowing spool seal to slip into valve body oil grooves. Valve assembly can be installed by pushing on the outer diameter of the valve body housing with the fingers of both hands. Make certain that white plastic rings are not binding on inside of housing. Valve assembly is properly seated when oil return hole in gear housing is fully visible.

5. Place Adjuster Plug Seal Protector, J-6222, over end of stub shaft.

6. Lubricate new adjuster plug O-ring seal with power steering fluid and install in groove on adjuster plug.

7. Install adjuster plug assembly over end of stub shaft, Fig. 9-51, and tighten just enough to make certain that all parts are properly seated in gear housing. Remove Seal Protector, J-6222.

(NOTE: If Seal Protector, J-6222 is removed too soon, stub shaft seal will be damaged by the shaft splines.)

8. Install adjuster plug locknut loosely on adjuster plug.

9. Adjust thrust bearing preload as described in Note 13 for 1974 model Cadillac's and Note 14 for earlier models.

10. Install Rack-Piston Seal Compressor, J-7576, in gear housing, Fig. 9-52, holding it tightly against shoulder in housing.

BACK TO INDEX

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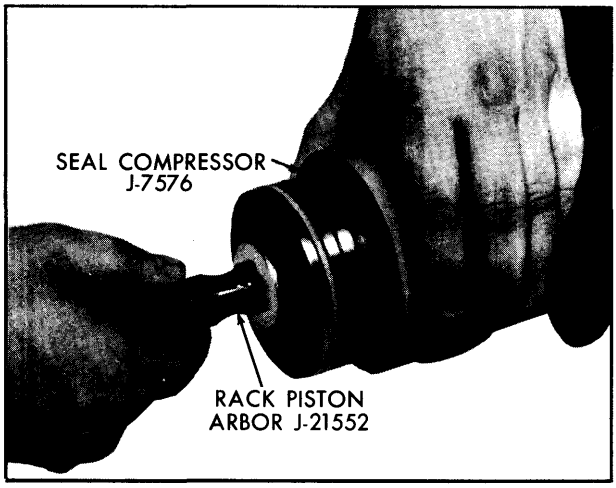


Fig. 9-52 Installing Rack Piston

11. Insert rack-piston into housing until arbor engages worm. Turn stub shaft clockwise, using a 3/4 inch twelve-point socket or box end wrench, to draw



Fig. 9-54 Loosening Adjuster Plug Lock Nut

rack-piston into housing. When piston-ring is in housing piston bore, Arbor J-21552, and Seal Compressor, J-7576, can be removed.

12. Turn stub shaft as necessary until middle rack

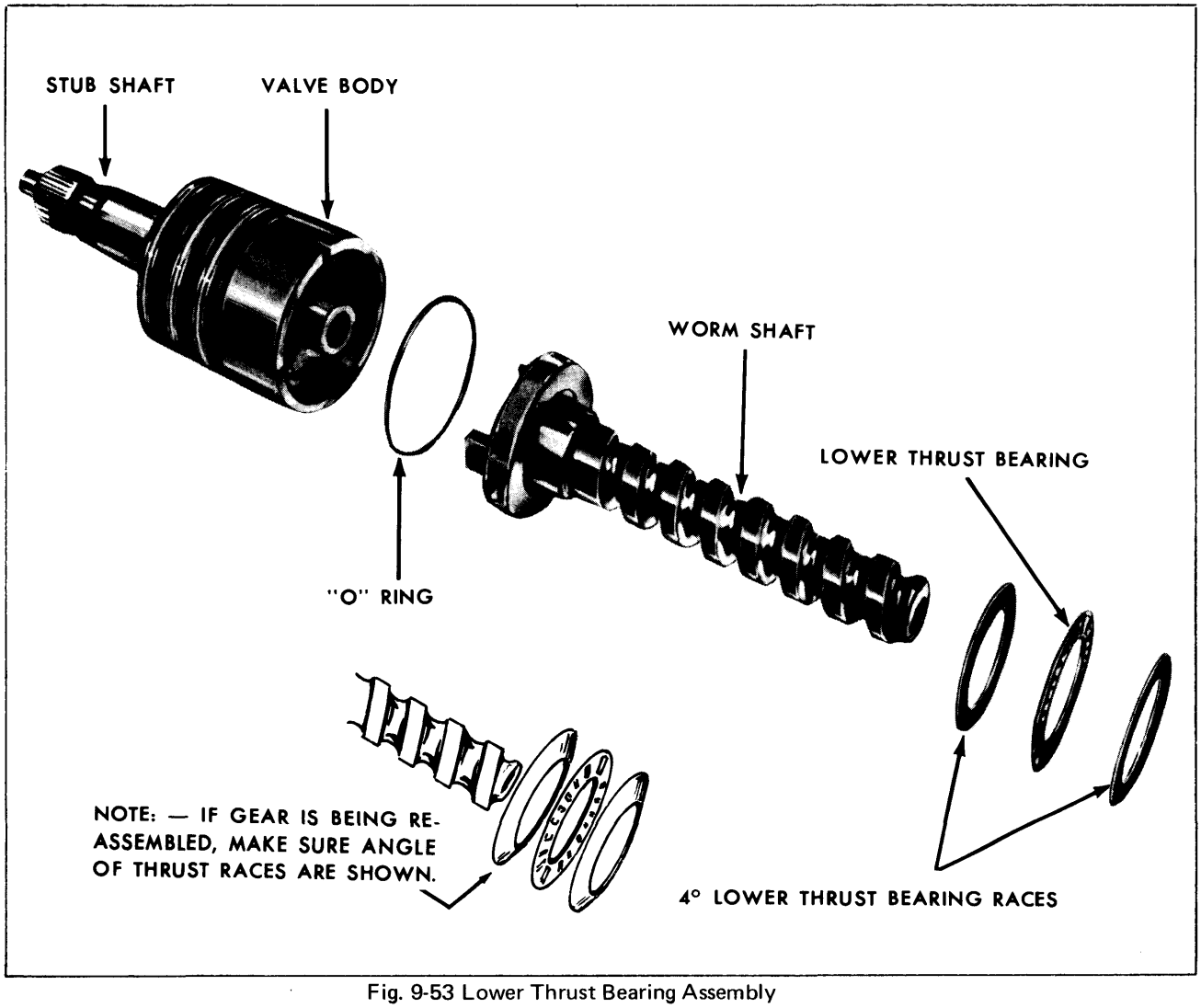


Fig. 9-53 Lower Thrust Bearing Assembly

BACK TO INDEX

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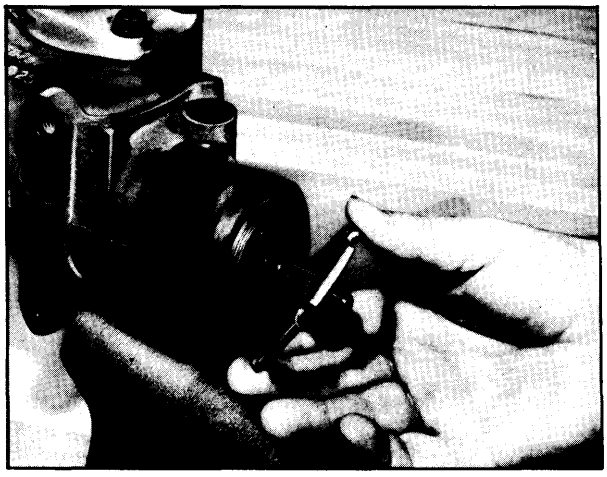


Fig. 9-55 Removing Adjuster Plug Lock Nut

groove in rack-piston is aligned with center of pitman shaft needle bearing.

13. Lubricate new side cover O-ring and install in face of side cover.

14. Install pitman shaft so that center tooth in sector meshes with center groove of rack-piston. Make sure side cover O-ring is in place before pushing side cover down on gear housing.

15. Install side cover screws and tighten to 30 foot-pounds.

16. Hold adjuster screw with Allen wrench and install new adjuster lock nut half way on adjuster screw.

17. Install rack-piston end plug in rack-piston. Tighten end plug to 80 foot-pounds.

18. Lubricate new housing end cover O-ring seal with power steering fluid and install in gear housing.

19. Insert end cover into gear housing and seat against O-ring seal. Slight tapping with a mallet may be necessary to seat end plug properly.

20. Snap end cover retainer ring into place with fingers. Slight tapping may be required to bottom retainer ring in the gear housing securely.

21. Adjust pitman shaft end play as described in Note 15.

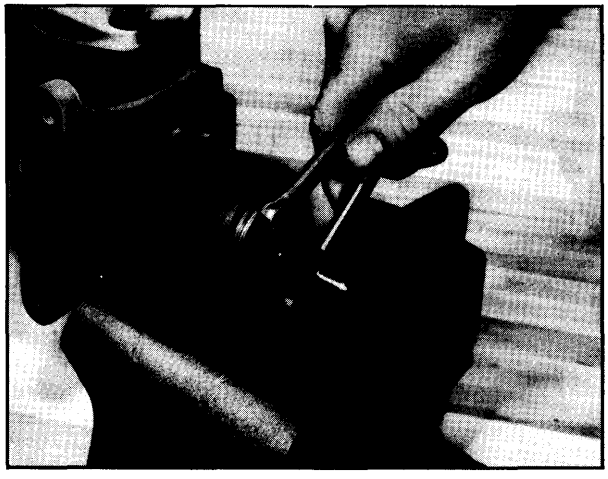


Fig. 9-56 Turning Adjuster Plug

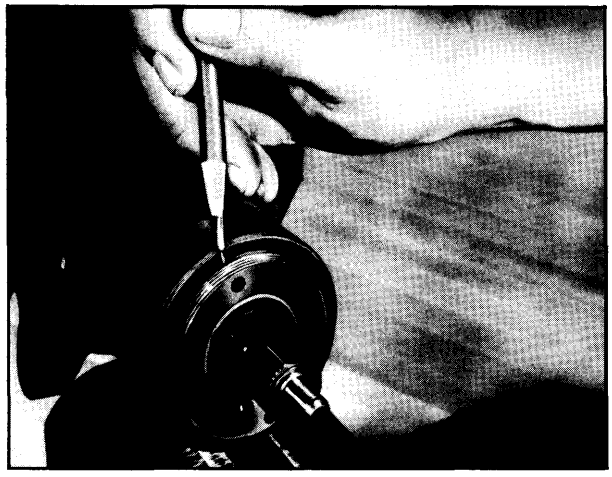


Fig. 9-57 Marking Housing

22. Install flexible coupling flange assembly on stub shaft with .040 inch clearance between the adjuster plug and the coupling. Install flange screw in coupling. Tighten screw to 30 foot-pounds.

(NOTE: At the start of the 1974 model year, all power steering gear assemblies incorporated a new input shaft lower thrust bearing configuration. The thrust bearing itself remains unchanged, but both bearing races are conical, and essentially become axial spring washers to prevent loss of thrust bearing preload for the life of the car, Fig. 9-53.)

13. Thrust Bearing Adjustment

If a gear is known to contain the new thrust bearing parts, thrust bearing adjustment in service is simplified. Recommended procedure:

1. Drain power steering fluid from gear by rotating the stub shaft full travel in both directions several times.

2. Loosen and remove adjuster plug lock nut, Fig. 9-54 and 9-55.

3. Turn the adjuster plug in (clockwise) until the plug and thrust bearing are firmly bottomed - approximately 20 foot-pounds, Fig. 9-56.



Fig. 9-58 Making Measurement

BACK TO INDEX

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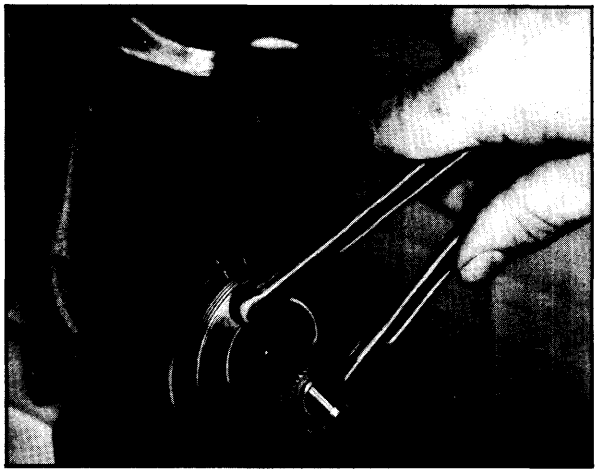


Fig. 9-59 Rotating Adjuster Plug

4. Mark the housing even with one of the holes in the adjuster plug, Fig. 9-57).

5. Measure back (counterclockwise direction) 3/16 to 1/4 inch and remark housing, Fig. 9-58.

6. Rotate adjuster (counterclockwise) until hole in adjuster is in line with second mark, Fig. 9-59.

7. Tighten lock nut securely. Hold (or have held) adjuster plug to maintain alignment of hole with mark, Fig. 9-60.

8. Turn the stub shaft to the right stop and then back 1/4 turn. Using an inch-pound torque wrench, measure the torque. Reading should be taken with beam of torque wrench near vertical while turning counter-clockwise at an even rate. Fig. 9-61. If reading is less than 4, or more than 10 inch-pounds, use alternate adjustment procedure in Note 14.



Fig. 9-60 Tightening Lock Nut

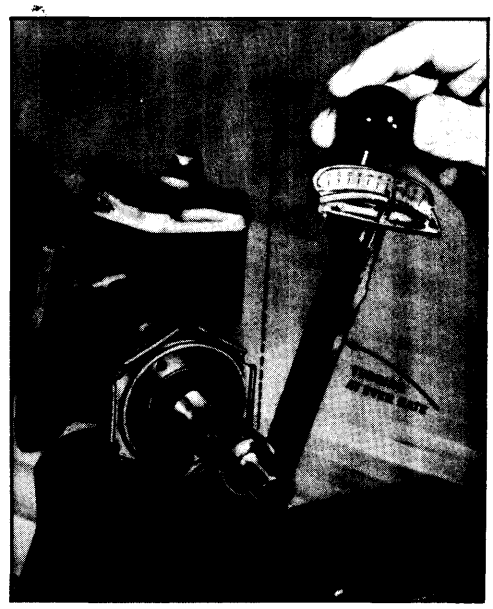


Fig. 9-61 Measuring Torque

14. Alternate Thrust Bearing Adjustment Procedure

(NOTE: Since past model steering gears, service kits, and service gears contain the flat, non-springy, thrust bearing races, the first adjustment procedure listed cannot be used. If there is any doubt about the



Fig. 9-62 Loosening Pitman Shaft Lock Nut

BACK TO INDEX

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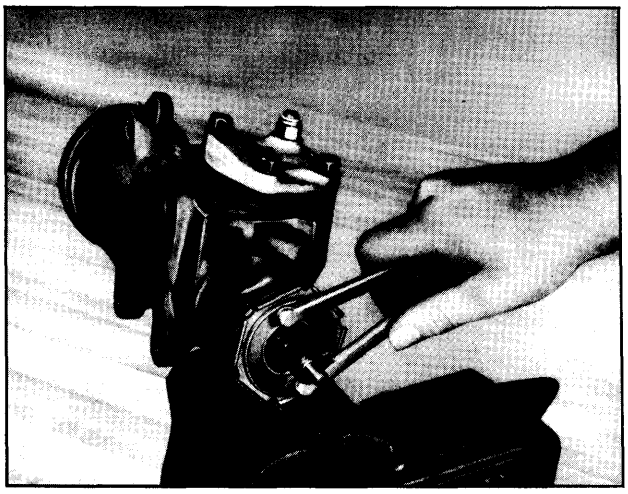


Fig. 9-63 Loosening Adjuster Plug

type of races, use this procedure to adjust the thrust bearing preload.)

1. Drain gear by rotating stub shaft from stop to stop several times.
2. Loosen pitman shaft preload adjuster screw lock nut and turn the preload adjuster screw 1-1/2 turns counterclockwise. Retighten the lock nut, Fig. 9-62. If when turning the preload screw counterclockwise, it bottoms, turn back clockwise one-half turn.
3. Loosen but, do not remove the adjuster plug lock nut, Fig. 9-54
4. Loosen the adjuster plug one turn counterclockwise, Fig. 9-63.

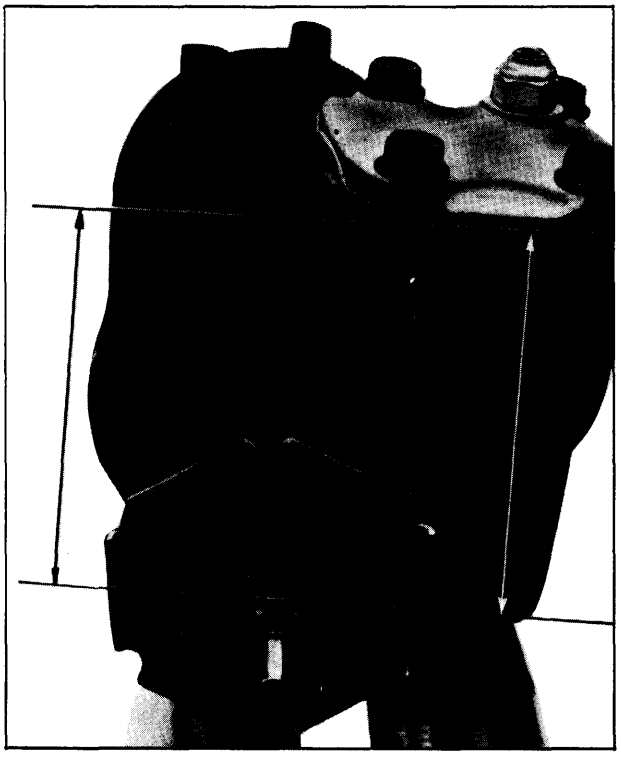


Fig. 9-64 Aligning Stub Shaft with Side Cover

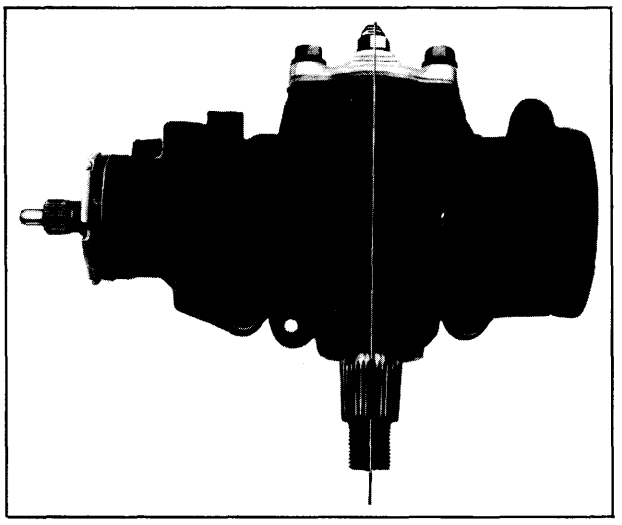


Fig. 9-65 Block Tooth on Pitman Shaft in Line with Over-Center Preload Adjuster

5. Turn the stub shaft to the right stop and then back a quarter turn. Measure the drag torque using an in. lb. torque wrench, Fig. 9-61. Bottom the adjuster plug firmly (approximately 20 foot-pounds) by turning it clockwise, Fig. 9-63. Then back it off until the total torque reading is 3-4 inch-pounds in excess of the drag torque. (Example: drag torque reading - 3 inch-pounds. Total torque reading with adjuster plug tightened - 6-7 inch-pounds.)
6. Tighten the adjuster plug lock nut securely, Fig. 9-60.

(NOTE: Preload torque tends to drop off when the lock nut is tightened. Therefore, the torque reading must be rechecked with the lock nut tight, and the torque must still be 3-4 inch-pounds in excess of the seal drag.)

CAUTION: It is not possible to properly adjust the thrust bearing preload unless the adjuster plug is firmly bottomed out and the torque set while the adjuster plug is being loosened. Never attempt to adjust the thrust preload while tightening or

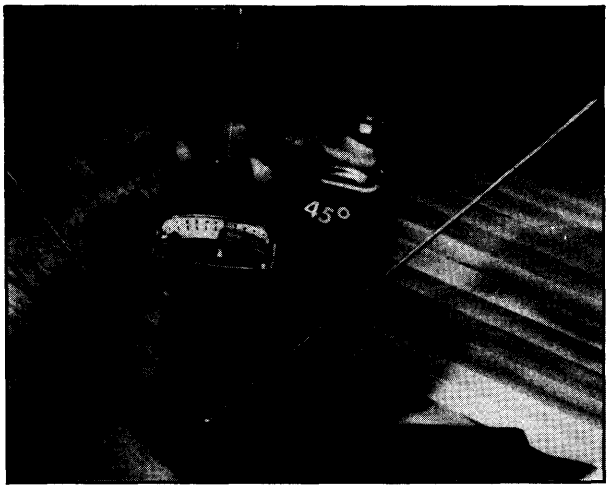


Fig. 9-66 Obtaining Correct "ON" Center Torque

BACK TO INDEX

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advancing the adjuster plug into the gear assembly.

7. Adjust pitman shaft "over-center" sector as described in Note 15.

15. Pitman Shaft "Over-Center" Sector Adjustment

1. Turn the stub shaft from stop to stop, counting the total number of turns. Divide this number by 2. Starting at either stop, turn the stub shaft 1/2 the total number of turns. This is the "center" of the gear. The flat on the stub shaft is normally up and parallel with the side cover when the gear is "on center", Fig. 9-64, and the block tooth on the pitman shaft is in line with the over-center preload adjuster, Fig. 9-65.

2. Rotate the torque wrench approximately 45 degrees each side of center, and "read" near or on center (highest reading), Fig. 9-61. Loosen the lock nut and turn the preload adjusting screw clockwise until the correct "ON" center torque, in excess of the reading just taken, is obtained, Fig. 9-66.

Limits for "new" and "used" gears are different, as follows:

a. "New" gear over-center torque to be 4-8 inch-pounds additional torque, but total over-center torque must not exceed 18 inch-pounds.

b. "Used" gear 400 or more miles. Over-center torque to be 4 to 5 inch-pounds additional torque, but total over-center must not exceed 14 inch-pounds.

Tighten the lock nut to 35 foot-pounds while holding the preload adjuster screw. Recheck the "ON" center adjustment.

16. Steering Gear Line Connector Seats and Poppet Check Valve Replacement

The following procedure can be performed on car as well as on bench.

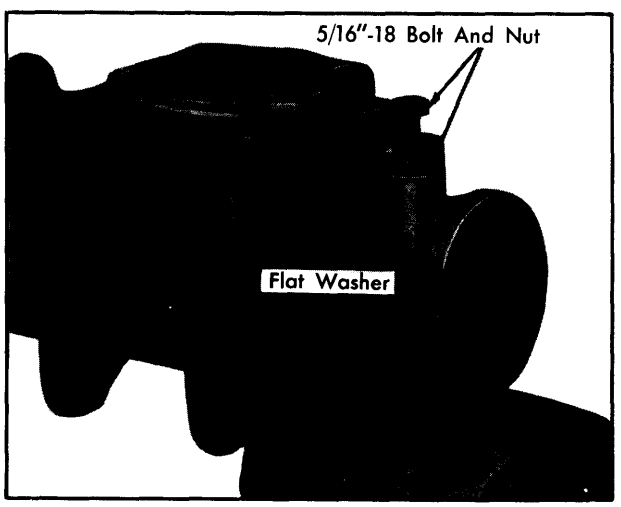


Fig. 9-67 Removing Line Connector Seat

1. Disconnect pressure and return lines at steering gear and plug lines to prevent loss of fluid.

2. To prevent metal chips from becoming lodged in valve assembly, pack inside of connector seats of pressure and return port housing with petrolatum or equivalent.

3. Tap threads in connector seats, using a 5/16"-18 tap.

CAUTION: Do not tap threads too deep in pressure hose connector seat as tap will bottom poppet valve against housing and damage it. It is necessary to tap only 2 or 3 threads deep.

4. Thread a 5/16"-18 bolt with a nut and flat washer into tapped hole, Fig. 9-67.

5. To pull connector seat, hold bolt from rotating while turning nut off bolt. This will pull connector from housing. Discard connector seat.

(NOTE: It is also possible to remove connector by using a No. 4 screw extractor.)

6. Wipe lubricant from housing and clean housing thoroughly to remove any metal chips or dirt.

7. Remove poppet check valve and spring from pressure port and discard.

8. Install new check valve spring in pressure port with large end down. Make sure spring is seated in counterbore in pressure port.

9. Install new check valve over spring with tangs pointing down. Make sure valve is centered on small end of spring.

10. Install new connector seats, using petrolatum or equivalent to hold connector seat on check valve in pressure port. Drive connector seats in place using Valve Connector Seat Installer, J-6217, Fig. 9-68.

11. Check operation of valve by pushing lightly against valve with a small punch or small rod. Valve should reseat itself against connector seat when pressure is removed from spring.

12. Connect pressure and return lines on steering gear. Tighten fittings to 30 foot-pounds.

13. Check fluid in pump reservoir and add if necessary.

17. Removal and Installation of Pitman Shaft Seals—On Car

If upon inspection of the gear, it is found that oil leakage exists at the pitman shaft seals, the seals may be replaced without removing the gear assembly from the vehicle as follows:

a. Removal

1. Remove pitman nut and disconnect pitman arm from pitman shaft using Puller, J-6632.

CAUTION: Do not hammer on end of puller.

2. Thoroughly clean end of pitman shaft and gear housing, then tape splines on end of pitman shaft to

BACK TO INDEX

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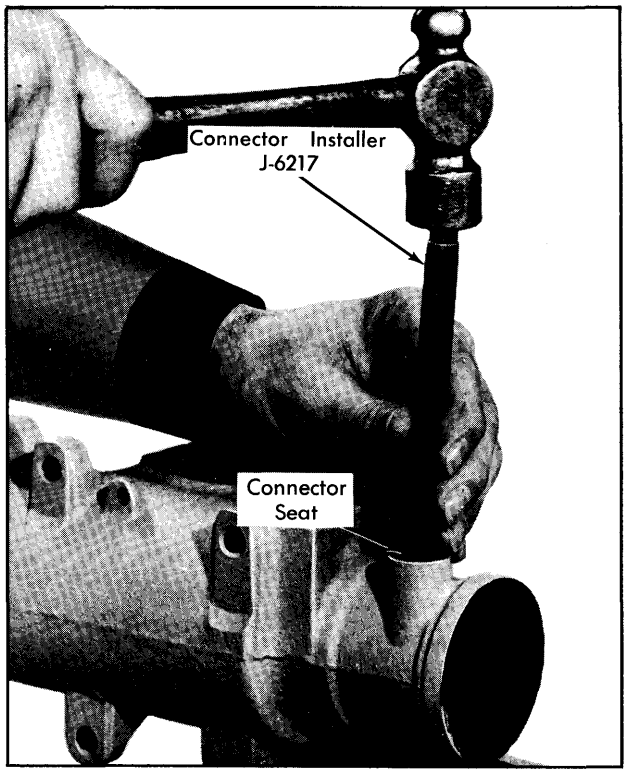


Fig. 9-68 Installing Line Connector Seat

insure that seals will not be cut by splines during assembly.

(NOTE: Use only one layer of tape. An excessive amount of tape will not allow seals to pass, due to close tolerance between seals and pitman shaft.)

3. Remove pitman shaft seal retaining ring with Snap Ring Pliers, J-4245.

4. Start engine and turn steering wheel fully to the left so that oil pressure in the housing can force out pitman shaft seals. Turn off engine.

(NOTE: Use suitable container to catch oil forced out of gear. This method of removing the pitman shaft seals is recommended, as it eliminates the possibility of scoring the housing while attempting to pry seals out. If pressure of oil does not remove seals, turn off engine and pry seals, being careful not to score seal bore in housing.)

b. Installation

1. Inspect seals for damage to rubber covering on O.D. If O.D. appears scored, inspect housing for burrs and remove before attempting new seal installation.

2. Clean end of housing thoroughly so that dirt will not enter housing with the installation of new seals.

3. Lubricate the seals thoroughly with power steering fluid and install seals with Installer, J-6219. Install inner single lip seal first, then back-up washer. Drive seal in far enough to provide clearance for outer seal, back-up washer, and retaining ring. Make sure that the inner seal does not bottom on counterbore. Install outer double lip seal and second back-up washer just far enough to provide clearance for the retaining ring. Install retaining ring.

4. Fill pump reservoir to proper level with power steering fluid. Start engine and allow engine to idle for at least three minutes without turning steering wheel. Turn wheel to left and check for leaks.

5. Remove tape and reconnect pitman arm, tightening nut to 185 foot-pounds.

See CAUTION on page 9-27.

18. Steering Linkage Removal, Disassembly, Assembly, and Installation—Except Eldorado

a. Removal

1. Remove cotter pins and nuts from outer tie rod pivots at steering arms.

2. Remove outer tie rod pivots from steering knuckles using Tie Rod End Puller, J-24319, Fig. 9-69. Be careful not to damage joint seals.

3. Remove idler arm support mounting screws and lockwashers from frame side member.

4. Remove pitman arm cotter pin and nut at steering linkage.

5. Remove steering linkage from pitman arm, using Puller, J-24319, Fig. 9-70.

6. Remove drag link with tie rods and idler arm attached.

b. Disassembly

1. Remove cotter pins and nuts from idler arm pivot and both inner tie rod pivots.

2. Remove tie rods, using Tie Rod End Puller, J-24319, Fig. 9-71.



Fig. 9-69 Removing Tie Rod End From Steering Knuckle

BACK TO INDEX

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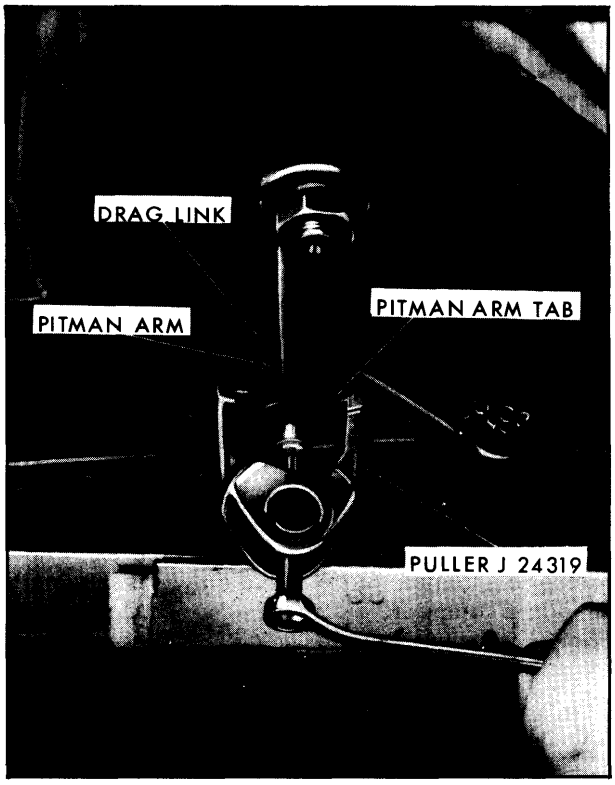


Fig. 9-70 Disconnecting Pitman Arm

3. Remove idler arm from drag link, using Puller, J-24319.

4. Remove dust seals from pitman arm and idler arm pivot studs.

5. Remove outer tie rod pivots by loosening nuts on outer clamp bolts and unscrewing outer tie rod pivots from adjuster tubes. Be careful not to pull pivot seal off pivot housing.

6. If necessary, remove clamps and adjuster tubes from ends of tie rods.

c. Assembly

1. If previously removed, lubricate adjuster tubes with chassis lubricant. Install adjuster tubes and clamps on ends of rods.

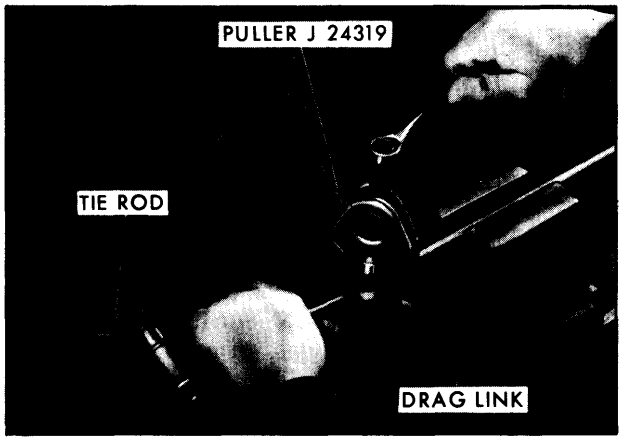


Fig. 9-71 Removing Tie Rod From Drag Link

2. Thread outer tie rod pivots into adjuster tubes, but do not tighten outer clamps.

(NOTE: An equal amount of thread must be exposed on both ends of the adjuster tubes.)

3. Install both tie rods on drag link tightening nuts to 60 foot-pounds, and install cotter pin.

See CAUTION on page 9-27.

4. Install new dust seal on idler arm pivot stud and install idler arm on drag link. Tighten nuts to 40 foot-pounds and install cotter pin.

(NOTE: If holes do not line up, continue to tighten until cotter pin can be inserted. Do not tighten nut more than 50 foot-pounds.)

5. Install new dust seal on pitman arm pivot stud.

6. Lubricate joints as described in Note 26.

d. Installation

See CAUTION on page 9-27, when performing Steps 2, 3 and 4.

1. Install idler arm support on frame side bar with two mounting screws and lockwashers. Tighten mounting screws finger tight.

(NOTE: To assure proper rotational capability of the idler arm pivot, screw the idler arm support shaft completely into the idler arm bushing. Then, unscrew the support shaft between 90° and 270° rotationally attaining alignment of the mounting holes with the frame.)

2. Install pitman arm at drag link stud. Tighten nut to 45 foot-pounds and install cotter pin.

(NOTE: If holes do not line up, continue to tighten until cotter pin can be inserted. Do not tighten nut more than 50 foot-pounds.)

3. Connect outer tie rod pivots to steering knuckles, tighten nuts to 37 foot-pounds and install cotter pins.

(NOTE: If holes do not line up, continue to tighten until cotter pin can be inserted. Do not tighten nut more than 50 foot-pounds.)

4. Turn steering wheel back and forth through the straight ahead position (without touching wheel stops) to align linkage. Then tighten idler arm bracket to frame attaching screws to 35 foot-pounds.

5. Adjust toe-in as described in Section 3, Note 2d.

19. Tie Rods

There are two tie rod assemblies used on all models. Each assembly is of three piece construction, consisting of an adjuster tube and an inner and outer tie rod. The tie rods are threaded into the adjuster tube and locked with clamps. Right and left hand threads are provided for toe-in adjustment and steering centering.

BACK TO INDEX

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The tie rods are self-adjusting for wear and require no attention in service other than periodic lubrication and inspection to see that ball studs are tight in the sockets. Replacement of tie rods should be made when excessive up and down motion is evident or if any lost motion or end play at ball end of stud exists.

a. Removal

If any tie rods are replaced front wheel toe alignment must be checked and reset as required to meet specification.

1. Place vehicle on hoist.
2. Remove cotter pins from ball studs and remove castellated nuts.
3. Disconnect tie rod from steering knuckle by using tool J-24319. See Fig. 9-69.
4. Remove inner ball stud from drag link using same procedure as described in Step 2 and 3. See Fig. 9-71.
5. To remove tie rods from the adjuster tube loosen clamp bolts and unscrew end assemblies.

(NOTE: Tie rod adjuster components often become rusted in service. In such cases, it is recommended that if the torque required to remove the nut from the bolt after breakaway exceeds 7 foot-pounds, discard the nuts and bolts. Apply penetrating oil between the clamp and tube and rotate the clamps until they move freely. Install new bolts and nuts having the same part number to assure proper clamping at the specified nut torque.)

b. Installation

1. If the tie rods were removed, lubricate the tie rod threads with EP Chassis lube and thread ends of tie rod into the adjuster tube making sure both ends are threaded and equal distance into the adjuster tube.

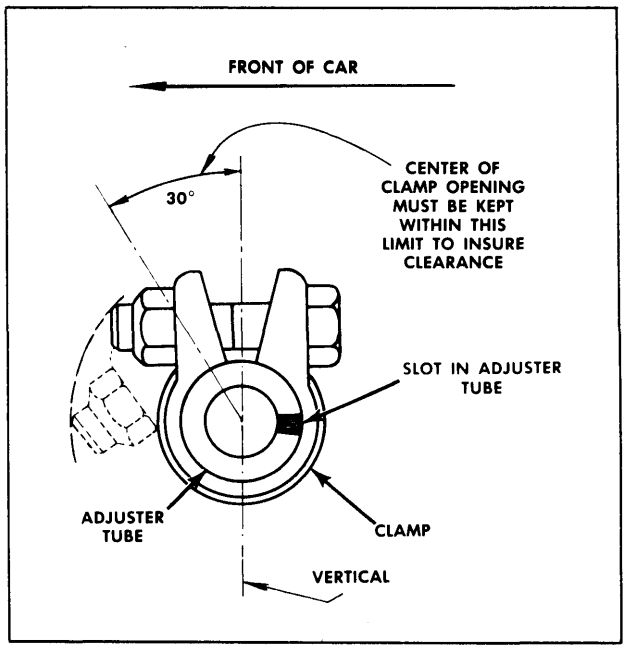


Fig. 9-72 Position of Adjuster Tube Clamp

2. Make sure that threads on ball stud and in ball stud nuts are perfectly clean and smooth. The ball stud must have no nicks on the taper. Inspect and replace damaged seals as necessary.
3. If seals were replaced lubricate joint as described in Note 26.

(NOTE: If threads are not clean and smooth, balls studs may turn in tie rod ends when attempting to tighten nut.)

3. Install ball studs in steering knuckle and drag link.
4. Install ball stud nuts and torque to specifications, then tighten nuts just enough to align slot in castellated nut with hole in stud and install cotter pins.

(NOTE: Before locking clamp bolts on the rods, make sure that the tie rod ends are in alignment with their ball studs by rotating both tie rods in the same direction as far as they will go and tighten adjuster tube clamps to specified torque. Make certain that adjuster tubes and clamps are positioned as shown in Fig. 9-72. Clamp positioning is not required for Cadillac C-D cars.)

5. Remove vehicle from hoist.
6. Adjust toe-in and align steering wheel.

20. Drag Link

If drag link is replaced front wheel toe alignment must be checked and reset as required to meet specification.

a. Removal

1. Place vehicle on hoist.
2. Remove inner tie rods from drag link as described in Note 19a.
3. Remove cotter pin and nut from drag link ball stud attachment at pitman arm.
4. Disconnect drag link from pitman arm by using tool J-24319. See Fig. 9-70.
5. Shift steering linkage as required to free pitman arm from drag link.
6. Remove cotter pin and nut from idler arm and remove drag link from idler arm in the same manner as the drag link is removed from the pitman arm in Step 4.

b. Installation

1. Inspect and replace damaged seals as necessary. If seals are replaced, lubricate joint as described in Note 25.
2. Install drag link to idler arm, making certain idler stud seal is in place, then install and tighten nut to specifications. Advance nut just enough to align castellation with cotter pin hole and install pin.
3. Raise end of rod and install on pitman arm. Tighten nut to specifications, then advance nut just enough to align slot in castellated nut with hole in stud and install cotter pin.
4. Install inner tie rods to drag link as described in Note 19b.

BACK TO INDEX

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5. Install ball stud nuts and tighten to specifications, then advance nut just enough to align slot in castellated nut with hole in stud and install cotter pin.
6. Remove vehicle from hoist.
7. Adjust toe-in and align steering wheel.

21. Tie Rod Adjuster Tube

If tie rod adjuster tube is replaced front wheel toe alignment must be checked and reset as required to meet specifications.

a. Removal

1. Place vehicle on hoist.
2. Remove cotter pins from ball studs and remove castellated nuts on outer tie rod at steering knuckle.
3. Disconnect tie rod from steering knuckle by using a tool such as J-24319. See Fig. 9-69.
4. Unthread outer tie rod end from adjuster tube.
5. Unthread adjuster tube from inner tie rod still connected to draglink.

(NOTE: Tie rod adjuster components often become rusted in service. In such cases, it is recommended that if the torque required to remove the nut from the bolt after breakaway exceeds 7 foot-pounds, discard the nuts and bolts. Apply penetrating oil between the clamp and tube and rotate the clamps until they move freely. Install new bolts and nuts having the same part number to assure proper clamping at the specified nut torque.)

b. Installation

1. Lubricate the tie rod threads with EP Chassis lube and thread ends of tie rod into the adjuster tube making sure both ends are threaded and equal distance into the adjuster tube.
2. Make sure that threads on ball stud and in ball stud nuts are perfectly clean and smooth. The ball stud must have no nicks on the taper. Inspect and replace damaged seals as necessary.

(NOTE: If threads are not clean and smooth, ball studs may turn in tie rod ends when attempting to tighten nut.)

4. Install ball studs in steering knuckle.
4. Install ball stud nuts and torque to specifications, then tighten nuts just enough to align slot in castellated nut with hole in stud and install cotter pins.

(NOTE: Before locking clamp bolts on the rods, make sure that the tie rods are in alignment with their ball studs by rotating both inner and outer tie rods in the same direction as far as they will go and then tighten adjuster tube clamps to specified torque. Make certain that adjuster tubes and clamps are positioned as shown in Fig. 9-72. Clamp positioning is not required for Cadillac C-D cars.)

5. Remove vehicle from hoist.
6. Adjust toe-in and align steering wheel.

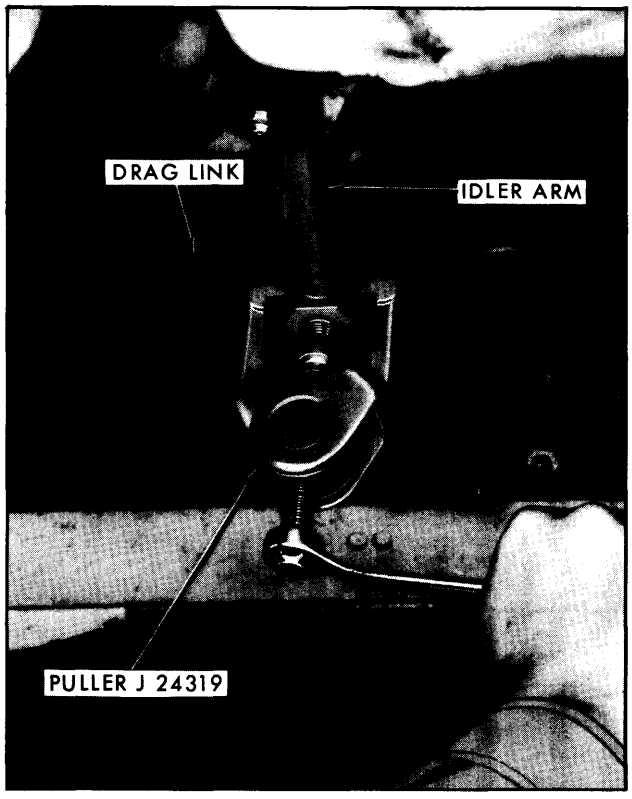


Fig. 9-73 Removing Idler Arm

22. Idler Arm—Except Eldorado

(NOTE: The idler arm assembly should be replaced if when an up and down force of 25 pounds is applied at the drag link end of the idler arm, the vertical lash exceeds 1/8".)

a. Removal

1. Place vehicle on hoist.
2. Remove idler arm support to frame washers and bolts.
3. Remove cotter pin and nut from idler arm to draglink ball stud.
4. Remove draglink from idler arm by using J-24319, Fig. 9-73.
5. Remove idler arm.

b. Installation

The linkage requires proper location of the idler arm on its threaded support so that the idler arm ball socket will be level with the pitman arm ball socket. The support must be threaded into the idler arm bushing until the distance from the center of the lower mounting bolt hole to the top of the idler arm boss is as indicated in Fig. 9-74. The position of the idler arm must be set before the idler arm assembly is installed in the vehicle.

(NOTE: To assure proper rotational capability of the idler arm pivot, screw the idler arm support shaft completely into the idler arm bushing. Then unscrew the support shaft between 90° and 270° rotationally

BACK TO INDEX
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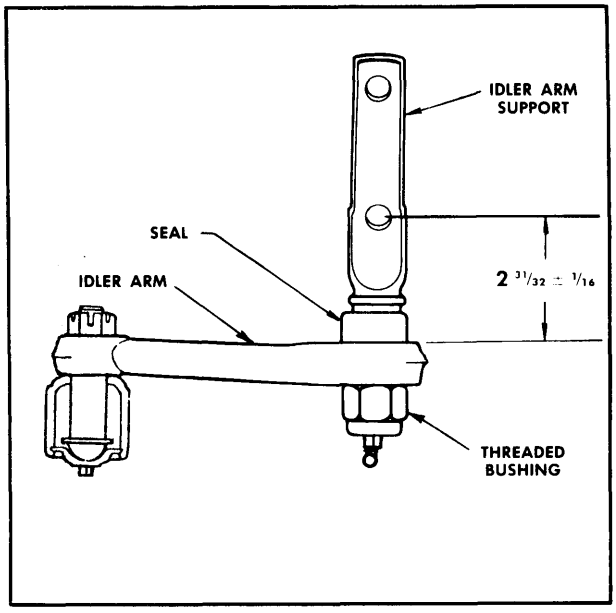


Fig. 9-74 Proper Location of Idler Arm on Threaded Bushing (except Eldorado)

attaining alignment of the mounting holes with the frame.)

1. Position support against frame, and secure with bolts and washers. Torque to 35 foot-pounds.
2. Install draglink to idler arm, making certain seal is on stud. Install and torque nut to 40 foot-pounds.
3. Advance nut just enough to align slot in castellated nut with hole in stud and install cotter pin.
4. Remove vehicle from hoist.

23. Pitman Arm—Except Eldorado

Removal

1. Place vehicle on hoist.
2. Remove cotter pin from pitman arm ball stud and remove nut.
3. Remove draglink from pitman arm using tool J-24319. See Fig. 9-70.
4. Remove pitman arm nut and lock washer from pitman shaft and discard. Mark relation of arm position to shaft.
5. Remove pitman arm with Tool J-9172.

CAUTION: Do not hammer on puller.

Installation

1. Install pitman arm on pitman shaft, lining up the marks made upon removal.
2. Install pitman shaft nut and lock washer. Use new nut and lock washer. Torque to specifications.
3. Position draglink to pitman arm. Install nut. Torque to specifications. Continue to tighten nut enough to align slot in castellated nut with hole in stud and install cotter pin.
4. Refer to torque specifications at rear of Section 9 for correct torque values.
5. Remove vehicle from hoist.

24. Tie Rod Pivot Seal Replacement

1. Raise car.
2. If replacing outer tie rod pivot seal on Eldorado remove front wheel.
3. Remove cotter pin and nut from outer tie rod pivot.
4. Remove outer tie rod pivot from steering knuckle using Tie Rod Pivot Puller, J-24319, Fig. 9-69. Remove inner tie rod pivot from drag link using Tie Rod Pivot Puller, J-24319, Fig. 9-71.
5. Pry old seal off pivot housing.
6. Wipe pivot and housing clean.
7. Position new seal on pivot stud. Using Seal Installer, J-21150-1, move flange of seal over seat on housing with a firm, even push.

(NOTE: Make certain that seal installer is positioned squarely on seal.)

8. Position tie rod to steering knuckle or drag link and install nut. Tighten nut on outer tie rod pivot to 37 foot-pounds. Tighten inner tie rod pivot nut to 60 foot-pounds.

See CAUTION on page 9-27.

9. Secure pivot nut with cotter pin.

(NOTE: If holes do not line up, continue to tighten nut until cotter pin can be inserted. Do not tighten outer pivot nut more than 50 foot-pounds.)

10. Lubricate joint as described in Note 25.
11. If outer pivot seals were replaced on Eldorado, install front wheel.
12. Lower car.

25. Steering Linkage Joint Lubrication

The steering linkage can be lubricated with any chassis lubricant meeting GM 6031-M specifications. Consult Section O for proper lubrication schedule.

26. Steering Wheel

a. Removal

CAUTION: Under no circumstances should the steering shaft be struck on the end in an effort to remove the steering wheel. This action will damage delicate parts of the steering column.

1. Remove three screws from back of spokes and lift pad assembly from wheel.
2. Remove horn contact wire from plastic tower by pushing in on wire and turning counterclockwise. Wire will then spring out of tower.

(NOTE: Turn ignition to On to facilitate removal.)

3. On Tilt and Telescope wheel proceed with steps 4 thru 6. On standard wheels proceed to step 7.

BACK TO INDEX

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Fig. 9-75 Steering Wheel Removal

4. Remove three screws securing the telescope locking lever assembly to flange and screw assembly.
5. Unscrew flange and screw assembly from steering shaft and remove.
6. Remove locking lever assembly.
7. Scribe an alignment mark on steering wheel hub in line with slash mark on steering shaft to be used at time of installation.
8. Loosen nut on steering shaft positioning it flush with end of shaft.
9. Carefully install Steering Wheel Puller, J-1859-03 with two 5/16"-18 x 4" bolts.
10. Tighten center bolt until steering wheel is loose on shaft, Fig. 9-75.
11. Remove puller.
12. Remove steering shaft nut.
13. Lift wheel off steering shaft.

CAUTION: When laying wheel face down, place a cloth on work bench to prevent laminated chrome, wood grain or stripes from being scratched or marked.

b. Installation

1. Install steering wheel, aligning scribe mark on hub with slash mark on end of shaft.

CAUTION: The steering wheel should not be driven on the steering shaft. This action may cause damage to the steering column components.

2. Install steering shaft nut and tighten it to 30 foot-pounds.

See CAUTION on page 9-27.

3. On Tilt and Telescoping columns, proceed to steps 4 through 7. On standard columns, proceed to step 8.
4. Install locking lever assembly on steering wheel.
5. Screw flange and screw assembly finger tight into steering shaft.
6. Position locking lever assembly against flange and screw assembly with lever in vertical position. Secure with three screws. Check operation of lever after tightening screws to assure proper release and tightening of telescoping shaft.
7. Check operation of telescoping mechanism by rotating locking lever against stops. Check to see that wheel is free to telescope in left position and is securely locked in right position.

(NOTE: When lever is securely locked, it should not contact steering wheel slot. If necessary, readjust as described in steps 5 and 6.)

8. Insert horn contact wire into plastic tower by pushing in against spring pressure and turning to the right to lock in position.
9. Position pad assembly on wheel and secure with three screws from rear side of wheel.

c. Alignment

In the event the steering wheel spokes are "off-center" when the car is being driven down the road, it will be necessary to align steering wheel or front wheels as described below:

1. Check steering wheel for proper position on steering shaft. With steering wheel "centered" in car, slot in flexible coupling upper shaft flange should be facing upward with scribe mark on upper end of steering shaft at "12 o'clock". If necessary, reposition steering wheel on shaft.
2. Drive car on a straight flat road to determine whether or not steering wheel is still "off-center".
3. If steering wheel is still "off-center", mark top of the wheel with a small piece of tape or crayon for reference when making correction.
4. Set wheel straight ahead and adjust tie rods. Shorten left tie rod and lengthen right tie rod if top of wheel is to the left of center, or shorten right tie rod and lengthen left tie rod if top of wheel is to the right of center. Be careful not to damage joint seals when adjusting tie rods.

(NOTE: Tie rod adjustment must be made on a wheel alignment machine so that correct toe-in setting is maintained.)

27. Steering Column Removal and Installation

(NOTE: If an electrical problem in the steering column is encountered, steering column analyzer, J-23980, is available as a diagnostic tool.)

a. Removal

1. Center steering wheel to gain access to flexible coupling pinch bolt.
2. Raise hood and disconnect negative battery cable.
3. Disconnect transmission linkage at lower shift lever.

BACK TO INDEX

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4. Remove clamp screw and lockwasher that secure flexible coupling upper flange to steering shaft on all cars except Eldorado. On Eldorado cars, remove lower steering shaft as described in Note 36a.

5. Remove steering column lower cover as described in Section 12, Note 31.

6. Disconnect turn signal wiring at connector.

(NOTE: If car is equipped with Cruise Control, disconnect harness at this time.)

7. Remove screw securing shift cable to shift bowl.

8. Loosen two vertical bolts at steering column upper support far enough to remove shim packs from either side of support and remove shims.

CAUTION: Do not remove upper support bolts at this time, as column may bend under its own weight.

9. Move rubber carpet seal at toe pan up the steering column as far as possible.

10. Position carpet out of way to gain access to column lower support bracket assembly.

11. Remove six screws securing lower mounting brackets to toe pan.

12. Remove clamp bolt and nut, separate mounting bracket halves and remove bracket assembly.

CAUTION: The lower support bracket assembly must be removed before the upper attachment screws are removed, as column may bend under its own weight.

13. Remove two bolts securing upper column bracket to column support and disconnect ignition and back-up light switch connectors and parking brake release hose.

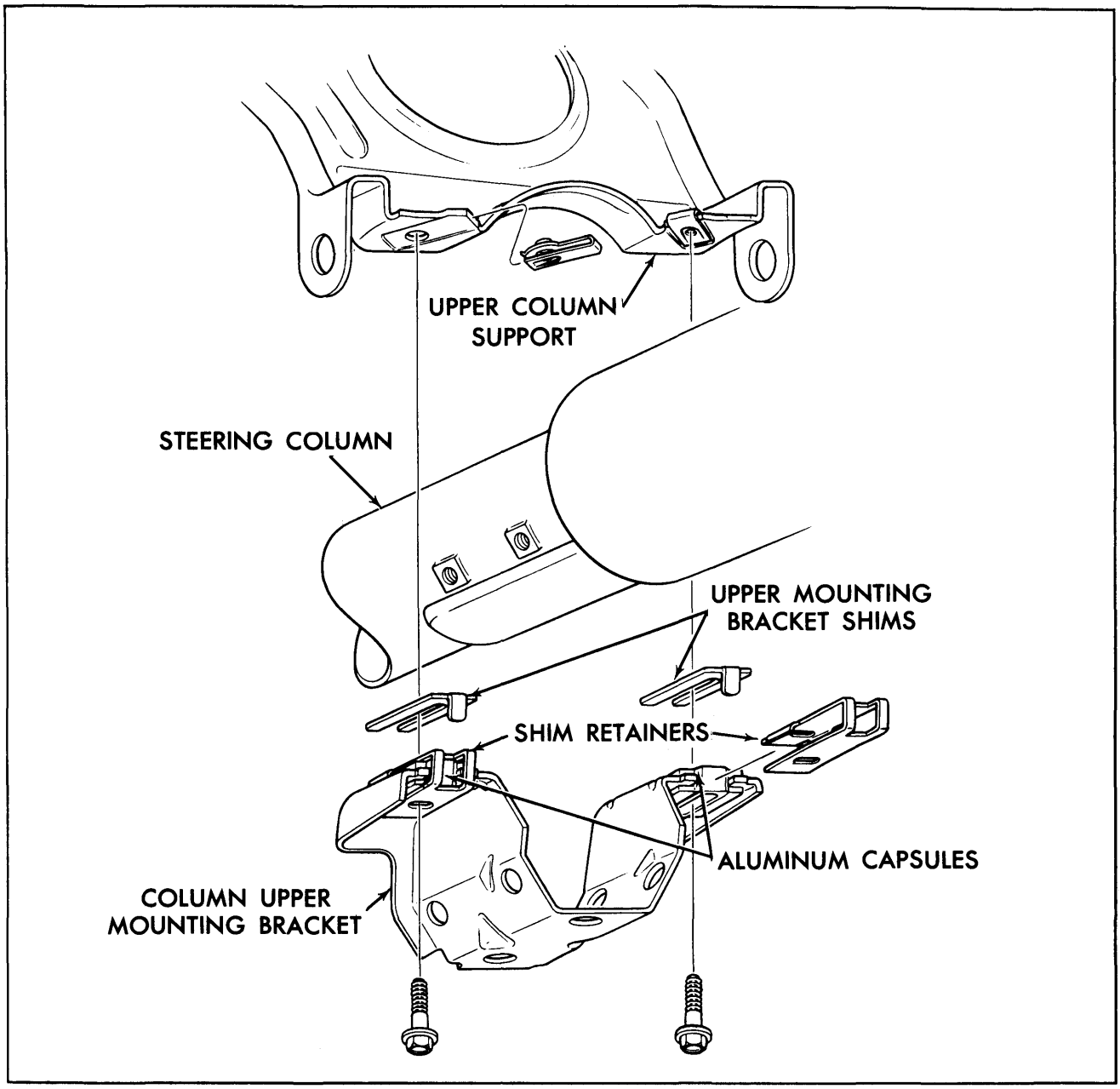


Fig. 9-76 Installing Steering Column Shims

BACK TO INDEX

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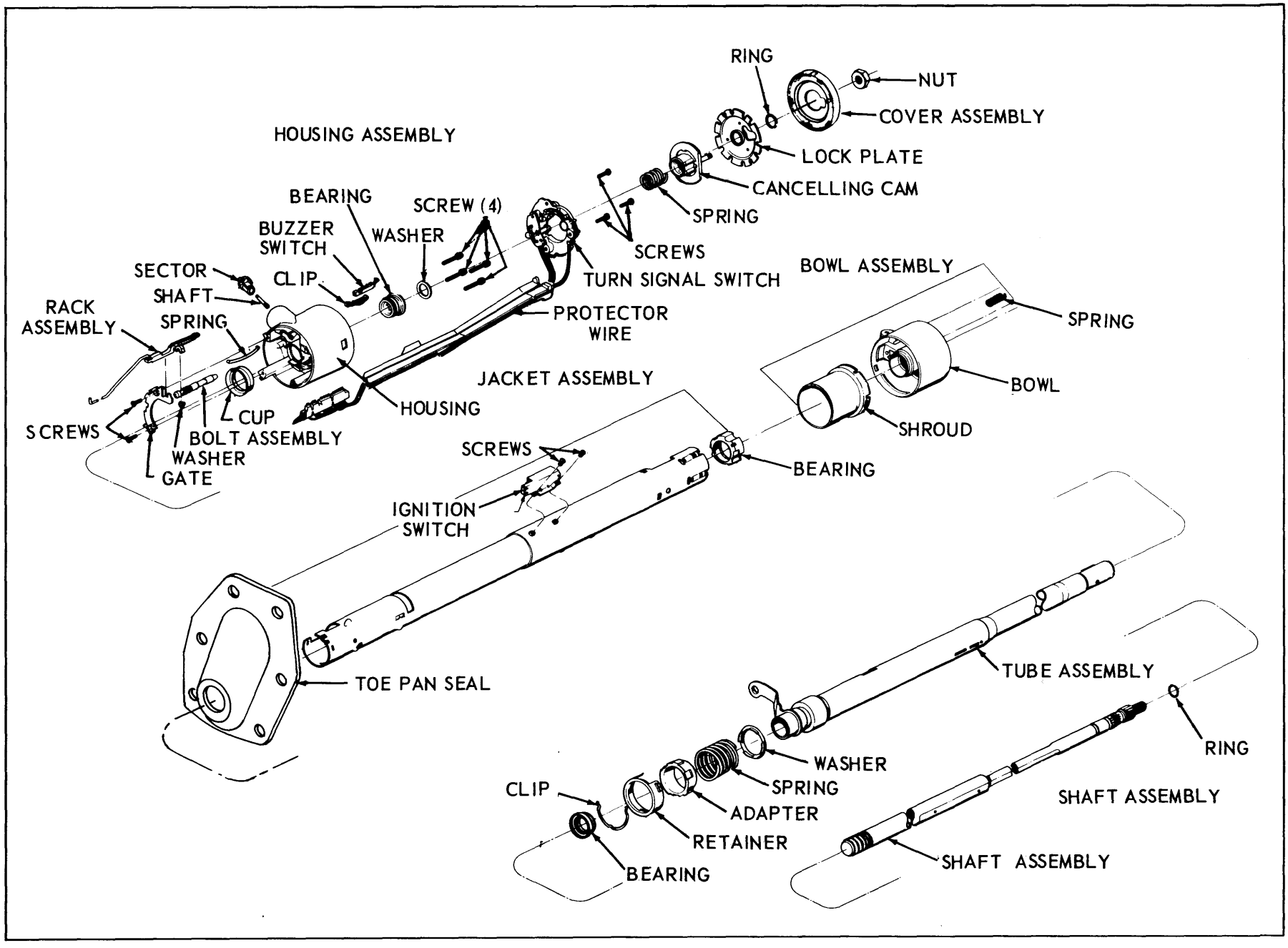


Fig. 9-77 Standard Steering Column Disassembled

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14. Carefully pull steering column up and out of car, being careful not to damage column mounted switches or dash seal.

(NOTE: If shaft hangs up in flexible coupling, reattach upper mounting bracket, then pry stub shaft from coupling with screwdriver.)

CAUTION: When laying wheel face down, place a cloth on work bench to prevent wheel from being scratched or marked.

15. Remove two shim retainers from upper mounting bracket.

b. Installation

1. Install two shim retainers on column upper mounting bracket.
2. If toe pan seal or carpet cover seal were removed, position seals on column.
3. Insert lower end of column through hole in toe pan and into flexible coupling, aligning flat on steering shaft with flat in coupling. Take care to avoid damage to lower shift lever and back-up light switch.
4. Plug in ignition switch connector and install two bolts to secure upper column bracket to upper column support. Do not torque bolts at this time.
5. Install column upper mounting bracket shims in the same location and quantity as found when column was removed, Fig. 9-76.

CAUTION: Place shims on top of shim retainers so that tangs on shims are fully inserted in retainer slot. Shims must not be placed directly against aluminum capsule.

6. Connect back-up light switch connector, parking brake release hose, and turn signal connector.

(NOTE: If car is equipped with Cruise Control, connect Cruise Control wiring harness at this time.)



Fig. 9-78 Cover Plate and Tower

7. Loosely install six screws securing lower mounting brackets to toe pan.
8. Connect mounting bracket. Clamp halves together and install clamp bolt and nut.
9. Connect linkage at lower shift lever.
10. Align steering column following procedure outlined in Note 5, steps 7 through 13.
11. Position shift pointer cable to shift bowl and secure with screw. Check for proper alignment.

28. Standard Steering Column Disassembly, Inspection, and Assembly—Out of Car (Fig. 9-77)

(NOTE: Extreme care must be taken when working on the column as certain parts of the assembly can be damaged if not handled correctly.)

a. Disassembly

1. Remove steering wheel as described in Note 26a.

CAUTION: When laying wheel facing down, place a cloth on work bench to prevent wheel from being scratched or marked.

2. Position screw driver blade into cover slots, Fig. 9-78. Pry up and out to free cover from lock plate.
3. Install spring Compressor, J-23131, on steering shaft, Fig. 9-79.
4. Compress lock plate and spring and remove snap ring from groove in shaft, Fig. 9-79. Discard snap ring.

CAUTION: The shaft could slide out bottom of column when snap ring is removed, causing damaged to shaft.

5. Remove lock plate by sliding plate up and off upper shaft.
6. Slide turn signal cancelling cam and upper bearing preload spring off upper steering shaft.
7. Slide thrust washer off upper steering shaft.

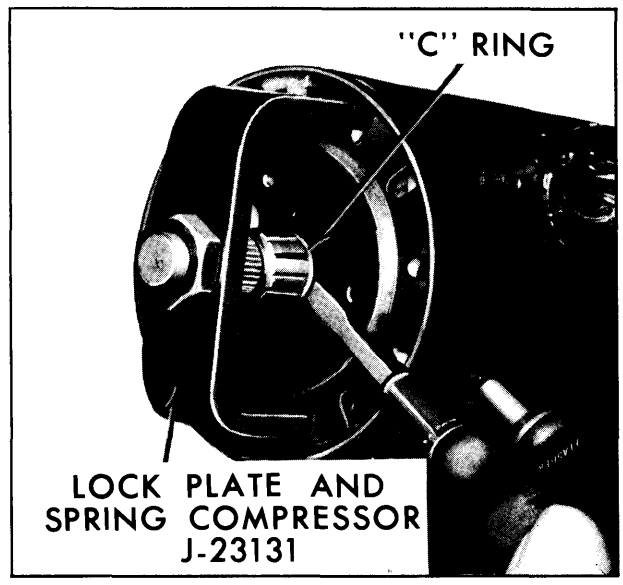


Fig. 9-79 Removing and Installing C-Ring (Standard)

BACK TO INDEX

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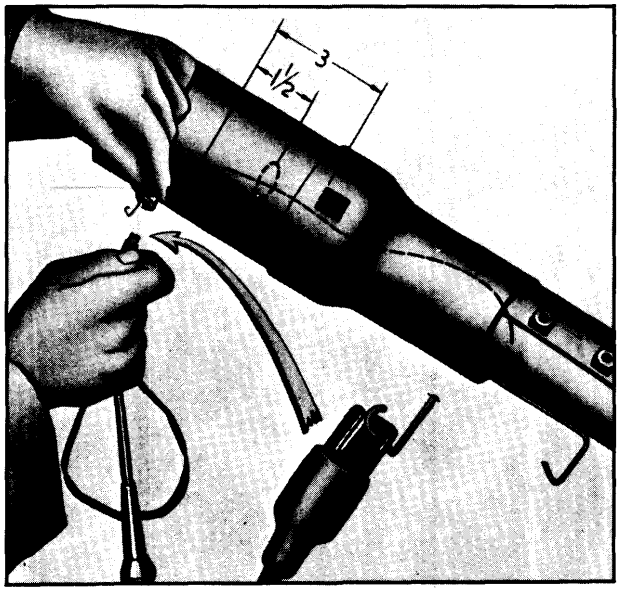


Fig. 9-80 Removing Cruise Control Harness



Fig. 9-82 Taping Connector

CAUTION: Care should be taken at this point. Steering shaft is free and could slide out of the column.

8. Push hazard warning switch in, remove cap from knob, remove screw and remove knob from column.

9. Remove turn signal lever screw and remove turn signal lever.

(NOTE: If car being worked on is equipped with Cruise Control, perform the following procedure.)

a. Attach a long piece of piano wire to connector on Cruise Control switch harness, Fig. 9-80.

b. Using extreme care, gently pull Cruise Control harness up through and out of column.

c. Remove piano wire from harness connector and secure lower end of piano wire to steering column.

(NOTE: Piano wire must be used so that Cruise Control harness can be guided through the proper passages on installation. Disassemble column by sliding internal components over wire, to permit location of passages for reassembly.)

10. Remove three turn signal switch mounting screws, Fig. 9-81.

11. Slide turn signal switch connector out of bracket on steering column jacket.

12. Wrap a piece of tape around the turn signal switch connector and harness, Fig. 9-82, to facilitate removal.

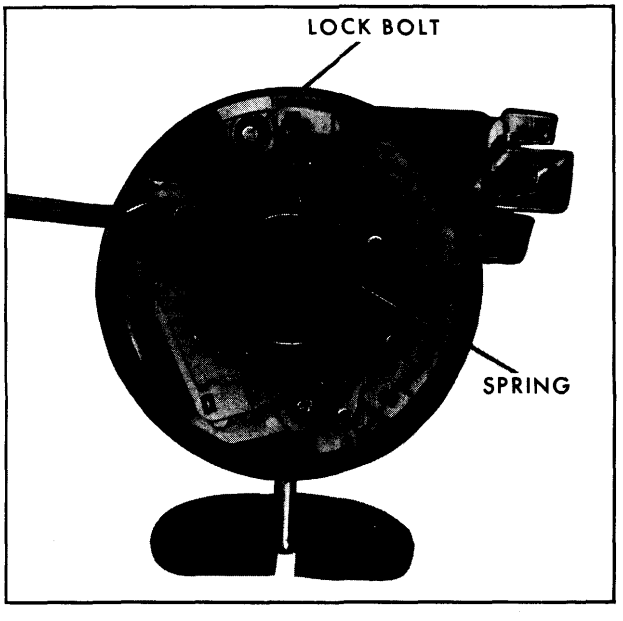


Fig. 9-81 Turn Signal Switch



Fig. 9-83 Removing Lock Cylinder

BACK TO INDEX

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13. Remove four bolts that secure upper mounting bracket to steering column and remove bracket.

14. Free turn signal switch wiring protector from bracket mounting bosses on upper column jacket.

15. Pull turn signal switch straight up with wire protector attached and remove switch, switch harness, and connector from column, Fig. 9-82.

16. Turn ignition switch to the On or Run position.

17. Insert a small, thin screwdriver into slot next to the switch mounting screw boss, Fig. 9-83. Depress lock cylinder retaining tab with screwdriver and remove lock cylinder.

18. Using a piece of stiff wire (such as a paper clip) hook wire in exposed loop of buzzer switch wedge spring, Fig. 9-84. Pull straight out on spring and remove switch and wedge spring.

CAUTION: If wedge spring is dropped on removal, spring could become lost in column, requiring complete disassembly of column.

19. Pull actuator rod as far as possible, then move rod back two detents.

20. Remove two screws securing ignition switch to lower steering column jacket. Slide switch off actuator rod and remove switch from column.

21. Support upper end of steering column and drive out shift lever pivot pin. Remove shift lever.

b. Upper Housing Diassembly—On Bench (Fig. 9-77)

1. Place shift bowl in Park position.

2. Remove four screws securing upper housing assembly to steering column jacket and remove housing assembly.

3. Remove thrust cap from housing.

4. Remove rack and lock bolt, Fig. 9-85.

5. Remove load spring from housing, and remove shift gate.

6. Remove sector through lock cylinder hole by pushing firmly on block tooth with a blunt punch, Fig. 9-86.

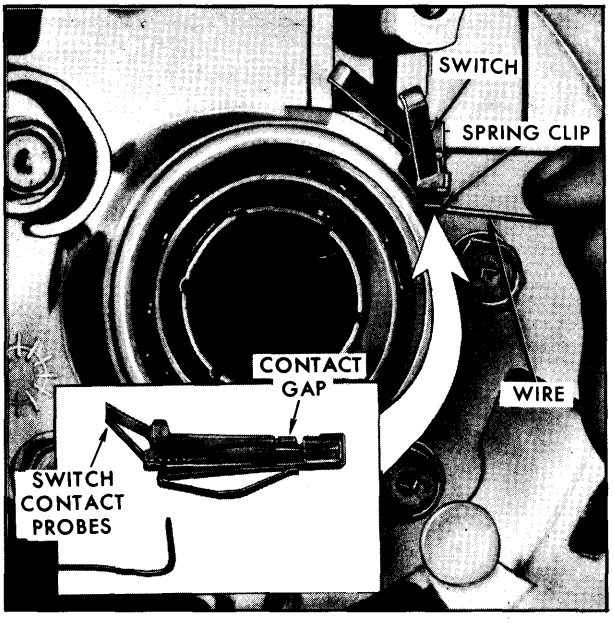


Fig. 9-84 Removing Buzzer Switch

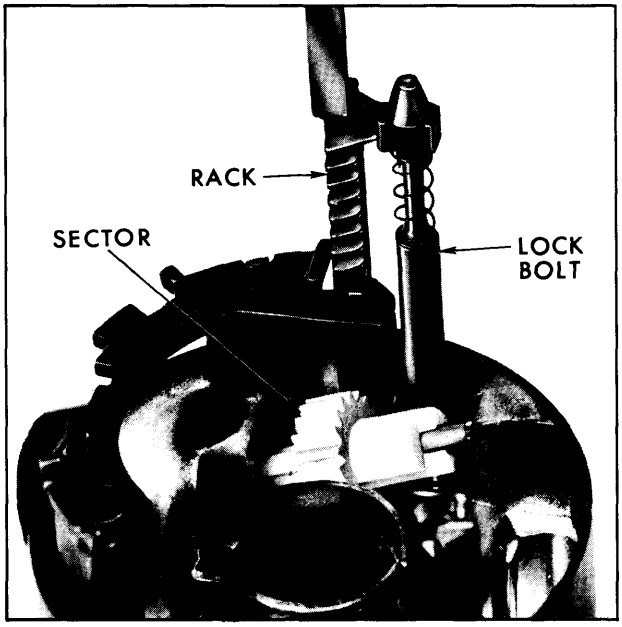


Fig. 9-85 Removing Rack and Lock Bolt

c. Shift Bowl and Shift Tube Disassembly

These parts are not to be removed from outer jacket. Where servicing is required, replace with complete shift bowl, shift tube, and outer jacket assembly.

d. Steering Shaft Removal—On Bench

1. Using a screwdriver, remove lower bearing adapter retaining clip.

2. Slide lower bearing reinforcement collar, bearing adapter and bearing, shift tube spring, and washer off shift tube and out of jacket.

(NOTE: Bearing may be removed from adapter by a light pressing operation on the outer race.)

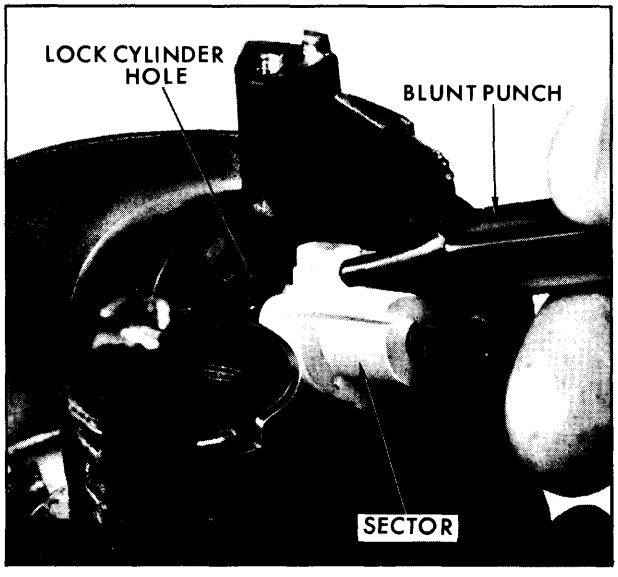


Fig. 9-86 Removing Sector

BACK TO INDEX

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3. Remove steering shaft through lower end of column.

e. Steering Shaft Installation (On Bench)

1. Install washer, shift tube spring, bearing adapter with bearing installed, and reinforcement collar onto lower end of column.
2. Hold bearing adapter and reinforcement collar in position and install retaining clip in slots in steering column jacket.
3. Slide steering shaft up into column from lower end.

CAUTION: Take care not to hit the drive tab on the back-up switch assembly when sliding shaft up through column.

f. Upper Housing Assembly—On Bench (Fig. 9-77)

(NOTE: Apply a thin coat of lithium grease or equivalent to all friction surfaces. If column is equipped with Cruise Control, assemble parts over piano wire used for disassembly to assure proper installation of Cruise Control harness.)

1. Install sector onto support shaft through lock cylinder hole with drive tang end of sector facing out. Press the sector onto shaft with a blunt punch.
2. Install shift gate in housing.
3. Insert rack spring in housing from bottom side.
4. Assemble lock bolt to cross-over arm of rack, Fig. 9-87.
5. Install rack and lock bolt assembly into the housing from the lower end of housing, with teeth up and toward centerline of column. Make sure wide tooth on sector aligns with wide gap at bottom end of rack.
6. Install thrust cup on bottom hub of housing.
7. Install ignition switch actuator rod through shift bowl and position housing on shift bowl. Secure housing to outer jacket with four screws. Torque to 60 inch-pounds.
8. Position wedge spring on buzzer switch with formed end of clip around the lower end of switch making the spring bow away from the switch.
9. Push switch and spring into hole in housing with switch contacts pointing toward the center of the column and up.

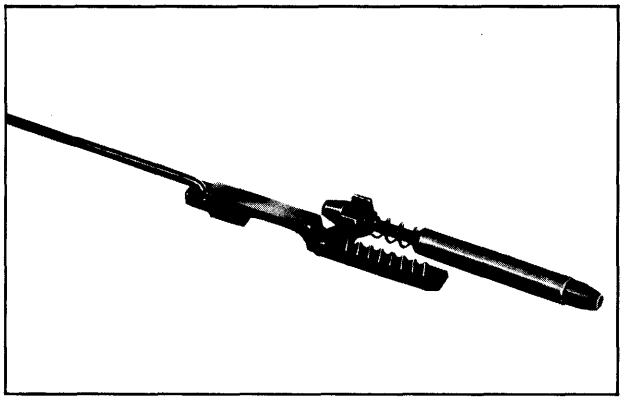


Fig. 9-87 Assembling Lock Bolt and Rack

10. Hold lock cylinder sleeve and rotate key clockwise against stop when viewed from key end. Make sure buzzer switch drive tang is below O.D. of lock cylinder.
11. Insert ignition lock cylinder and sleeve assembly into housing bore with key on cylinder sleeve aligned with keyway in housing. Maintaining a light push inward on cylinder, push until drive section of cylinder touches sector.
12. Rotate key counterclockwise while maintaining inward pressure until lock sector drive engages sector drive. Then, push in until lock cylinder retaining tab pops into groove and lock cylinder is secured in housing. Check freedom of lock cylinder rotation. There must be a free spring return from Start to Run position.

(NOTE: A 1/16" drill shank gage must be inserted between the lock cylinder knob and the column housing to avoid assembling the lock cylinder into the column beyond its normal position.)

13. Assemble ignition switch on actuator rod and adjust to the Lock position.

(NOTE: The Lock position can be found by holding the switch actuating rod stationary with one hand, then moving the switch toward the bottom of the column with the other hand until the end of travel in the switch has been reached. This is the Accessory position. Next back off one detent in the switch and this will be the Lock position. Make sure the ignition key is in the Lock position, then assemble the ignition switch to the column using the two screws provided. Take care to assure proper engagement of drive rod and switch slider without moving from Lock position. Tighten screws to 35 inch-pounds.)

CAUTION: When replacing or adjusting ignition switch:

1. *Be sure battery is disconnected.*
2. *Set switch in OFF-UNLOCKED.*
3. *Put gearshift in "N".*
4. *Turn key toward LOCK and hold while installing switch.*
5. *Re-install column and assure that lever moves freely from "P" to "L".*
6. *Re-connect battery cable.*
7. *Apply service brake and assure that engine starts in "P" and "N", but not in "R", "D", or "L".*

If either the ignition switch or column jacket is replaced, any "witness" marks on the switch bracket must be removed by flattening and the ignition switch adjusted per the above procedure.

CAUTION: Always check the start system as directed on the instruction label before releasing the vehicle.

CAUTION: Use only those screws provided for the ignition switch.

14. Install turn signal switch, feeding the harness, connector and harness protector down through the housing, Fig. 9-82.
15. Position turn signal switch in neutral position

BACK TO INDEX

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and install three screws securing switch to upper housing, Fig. 9-81. Tighten screws to 35 inch-pounds.

16. On cars equipped with Cruise Control, perform the following procedure.

a. Connect Cruise Control harness connector to piano wire used on removal, Fig. 9-80.

b. Feed Cruise Control harness into turn signal lever opening in steering column housing assembly. Next, gently pull on piano wire and pull Cruise Control harness through the steering column and into position.

c. Remove tape from turn signal wire harness.

d. Remove piano wire from harness connector.

e. Position turn signal lever on turn signal switch and secure lever to turn signal switch with one screw. Tighten screw to 35 inch-pounds.

17. Position turn signal switch wiring protector over upper bracket mounting bosses on upper steering column.

18. Position steering column upper mounting bracket over turn signal wiring harness protector and secure bracket to column with four screws. Tighten screws to 20 foot-pounds.

19. Install turn signal switch connector in bracket on steering column upper jacket.

20. Install hazard warning switch knob.

21. Install thrust washer on steering shaft.

22. Install upper bearing preload spring and turn signal cancelling cam.

23. Install lock plate with large flat on plate aligned with large flat on steering shaft.

24. Place a new snap ring on upper end of steering shaft.

CAUTION: Do not use old snap ring because ring becomes distorted upon removal.

25. Install Spring Compressor, J-23131, on steering shaft, Fig. 9-79.

26. Compress lock plate and spring. Next slide new snap ring down shaft until ring locks in groove in upper end of shaft. Remove spring compressor tool.

27. Position plastic lock plate cover on upper end of shaft and snap the three fingers over lock plate assembly. Turn shaft to make certain cover does not contact upper housing assembly. Install shift lever.

28. Install steering wheel as described in Note 26b.

29. Install steering column into car as outlined in Note 27b.

29. Steering Column Lower Bearing Removal

a. Removal

1. Remove steering gear from car, following Note 9a, Steps 1 through 6.

(NOTE: If car being worked on is an Eldorado, disregard Note 9a and remove lower shaft as described in Note 36a.

2. Remove lower bearing adapter retaining clip and reinforcement collar.

3. Carefully pry lower bearing and adapter assembly from shaft.

4. Pry bearing assembly out of adapter and discard bearing.

b. Installation

1. Install new lower bearing into bearing adapter.

CAUTION: Make certain that bearing is properly seated in adapter.

2. Install bearing and adapter on shaft and up into steering column lower jacket.

3. Install reinforcing collar over end of jacket.

4. Install retaining clip that holds adapter and collar to jacket.

5. Install steering gear as described in Note 10b, Steps 1 through 6.

(NOTE: If working on an Eldorado, disregard Note 9b and install lower shaft as described in Note 36b.)

30. Steering Shaft

In the event that the two nylon shear pins in the energy-absorbing steering column break due to impact not strong enough to collapse steering column jacket or shift tube, steering shaft must be repaired ONLY in the manner prescribed below.

(NOTE: If jacket or shift tube collapse, column must be replaced as an assembly.)

1. Remove steering column from car as outlined in Note 27a.

2. Remove steering shaft from column as described in Note 28d for standard column or Note 31b, for Tilt and Telescope column.

3. Pull upper solid shaft out of lower tube shaft approximately 3/8" or until a stop is felt. Plastic will be just visible.

(NOTE: It should not be necessary to repair the lower plastic joint in a two-joint shaft.)

4. Obtain a steering shaft repair kit. Kit consists of three snap rings and a supply of special primer and adhesive. Materials in kit are sufficient to service three cars.

5. Wipe shaft clean and dry for about one inch from tube.

6. Spray this area liberally with special primer. Allow not more than 20 minutes to dry.

7. Spread a 3/8" wide strip of special adhesive around primed area of shaft, and push shaft together until proper overall length is obtained.

STEERING SHAFT LENGTHS

	Standard Column	Tilt and Telescope Column
All Except Eldorado	36-31/32	30-13/32
Eldorado	37- 1/16	30-17/32

Allow joint to set up at least five minutes, then wipe off excess adhesive. Adhesive will harden to 350 lbs. yield strength.

BACK TO INDEX

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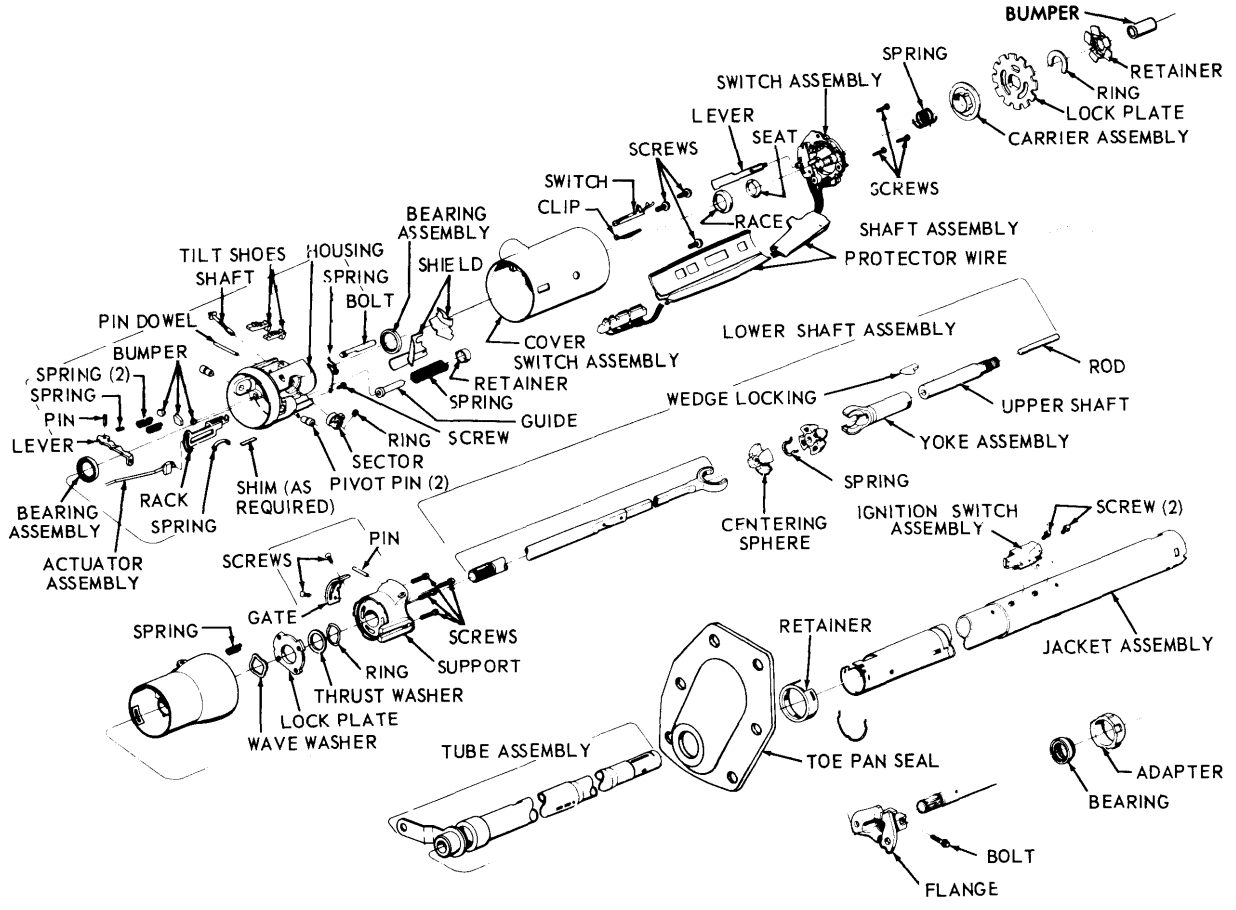


Fig. 9-88 Tilt and Telescope Steering Column Disassembled

BACK TO INDEX

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8. Install shaft into column using a new snap ring, as outlined in Note 28e for standard column or Note 31h for Tilt and Telescope column.

9. Install column in car, Note 27b.

31. Tilt and Telescope Column Disassembly, Inspection, and Assembly—Out of Car (Fig. 9-88)

(NOTE: Extreme care must be taken when working on the column as certain parts of the assembly may be damaged if handled incorrectly.)

a. Disassembly

1. Remove steering wheel as described in Note 26a.

CAUTION: When laying wheel face down, place a cloth on work bench to avoid scratches or marks on steering wheel.

2. Slide rubber sleeve bumper from steering shaft.

(NOTE: Save rubber sleeve bumper as it must be reinstalled at column assembly. If distorted, it should be replaced with a new bumper.)

3. Remove plastic retainer, using small screwdriver to disengage tabs on retainer from C-ring.

4. Install Spring Compressor, J-23063, on steering shaft, Fig. 9-89 threading bolt into steering shaft telescoping lock hole.

(NOTE: When installing spring compressor, pull upper shaft up 1" from bottomed position, then turn ignition to Lock to hold shaft in place.)

5. Compress upper steering shaft preload spring and remove C-ring, Fig. 9-89.



Fig. 9-89 Removing and Installing C-Ring (T & T)

6. Remove Spring Compressor, J-23063, and remove upper steering shaft lock plate, horn contact carrier and upper steering shaft preload spring.

7. Remove four screws and washers securing upper mounting bracket to column and remove bracket.

8. Slide harness connector out of bracket on steering column jacket.

9. Slide harness protector down to harness connector and remove protector from column.

10. Wrap a piece of tape around upper part of harness and connector, Fig. 9-82.

11. Remove cap from hazard warning flasher button, remove screw and remove button from column.

12. Position shift bowl in park position.

13. Unscrew turn signal lever and remove lever from column.

(NOTE: On cars equipped with Cruise Control, perform the following procedure:)

a. Slide harness protector down to harness connector. Then open protector and remove protector from harness.

b. Attach a piece of piano wire to the switch harness connector.

c. Unscrew turn signal lever, being sure to pass Cruise Control harness over the lever each time the turn signal lever makes one complete turn.

d. Gently pull Cruise Control harness out through turn signal lever opening.

e. Gently pull remainder of harness up through and out of column.

f. Disconnect guide wire from connector and secure wire to column.

(NOTE: Piano wire must be used so that Cruise Control harness can be guided through the proper passages on installation. Disassemble column by sliding internal components over wire to permit location of passages for reassembly.)

g. Remove turn signal lever from car.

14. Remove three mounting screws and pull turn signal switch straight up until connector is inside shift bowl. Remove hazard warning flasher lever from switch assembly. Allow switch assembly to hang from column.

15. Turn ignition key to Run position.

16. Insert a small, thin screwdriver into slot next to mounting screw boss, Fig. 9-83. Depress center of lock cylinder retaining tab with screwdriver and remove lock cylinder.

17. Using a piece of stiff wire, hook wire in exposed loop of buzzer switch wedge spring, Fig. 9-84. Pull straight out on spring and remove switch and wedge spring.

CAUTION: If wedge spring is dropped on removal, spring could become lost in column, requiring complete disassembly of column.

18. Remove tilt release lever.

19. Remove three screws securing cover to upper housing and dislodge cover from housing. Allow cover to rest on turn signal switch.

20. Pull carefully on wiring harness until connector is removed from housing.

BACK TO INDEX

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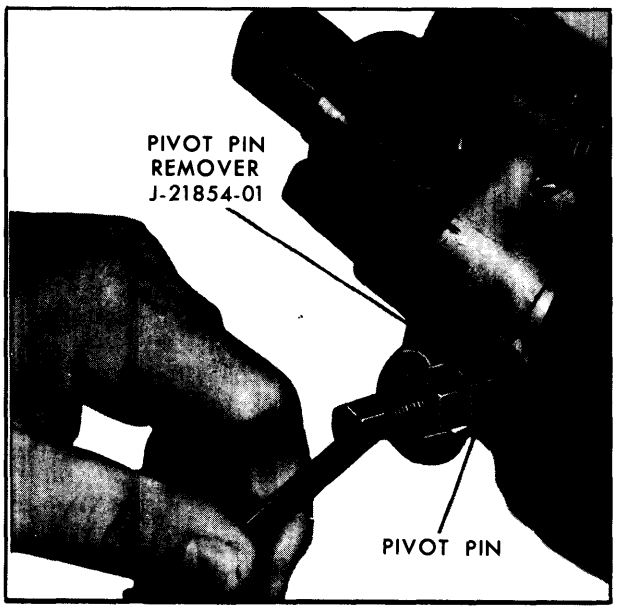


Fig. 9-90 Removing Pivot Pin

21. Install tilt release lever and position housing in full up position.

22. Using a wide bladed screwdriver, remove tilt spring by pushing in and turning spring retaining cap counterclockwise.

23. Remove two screws securing ignition switch to steering column jacket. Slide switch off actuator rod and remove switch from column.

24. Install Pivot Pin Remover, J-21854-01, and remove pivot pins, Fig. 9-90.

25. Pull back on tilt release lever to release upper housing tilt shoes, disconnect actuator rod, and slide upper housing off column. Remove bearing inner race and retainer from upper housing.

26. Remove actuator rod.

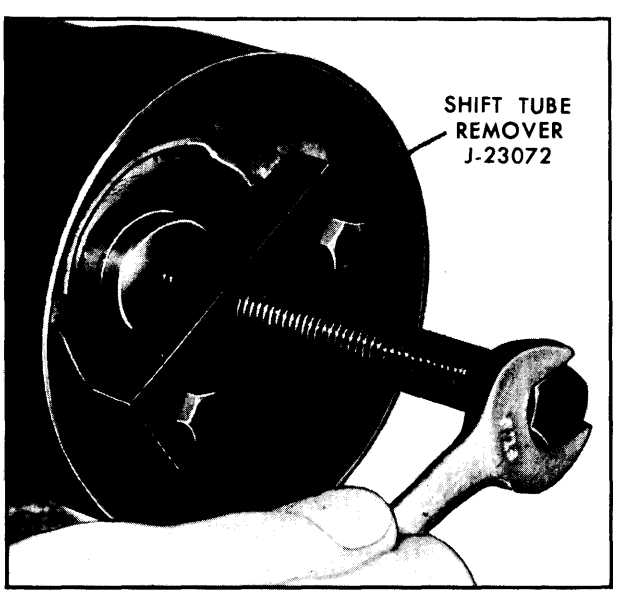


Fig. 9-91 Removing Shift Tube

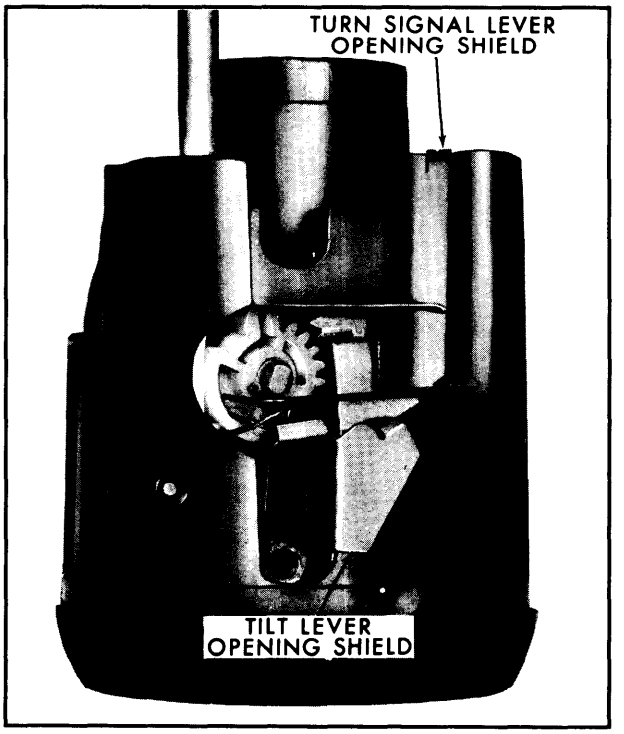


Fig. 9-92 Lever Opening Shields

b. Steering Shaft and Support Removal

1. Using a screwdriver, dislodge and remove lower steering shaft bearing retainer clip, bearing adapter and bearing.

2. Carefully pull steering shaft out of upper end of column.

3. Remove four screws securing support assembly to steering column and remove support assembly.

4. Turn upper portion of shaft at a right angle (90°) to the lower shaft to disassemble the U-joint.

5. Remove two-piece plastic centering sphere from upper yoke by rotating sphere so flats align with open end of yoke, then remove sphere.

c. Shift Tube Removal

1. Remove one screw and strap securing backup light switch to lower steering column jacket and remove switch.

2. Remove shift tube retainer clip.

3. Secure Shift Tube Remover, J-23072, to plate lock and remove shift tube from column, Fig. 9-91.

CAUTION: Use extreme care when removing shift tube to prevent lower shift lever arm from getting caught at lower end of column jacket resulting in separation of the lower and upper outer jackets at the collapse joint. If separation occurs, a new outer jacket assembly will be required.

4. Remove thrust washer, plate lock, and wave washer and remove shift bowl.

d. Upper Housing Disassembly

1. Remove tilt lever and opening shield and turn

BACK TO INDEX

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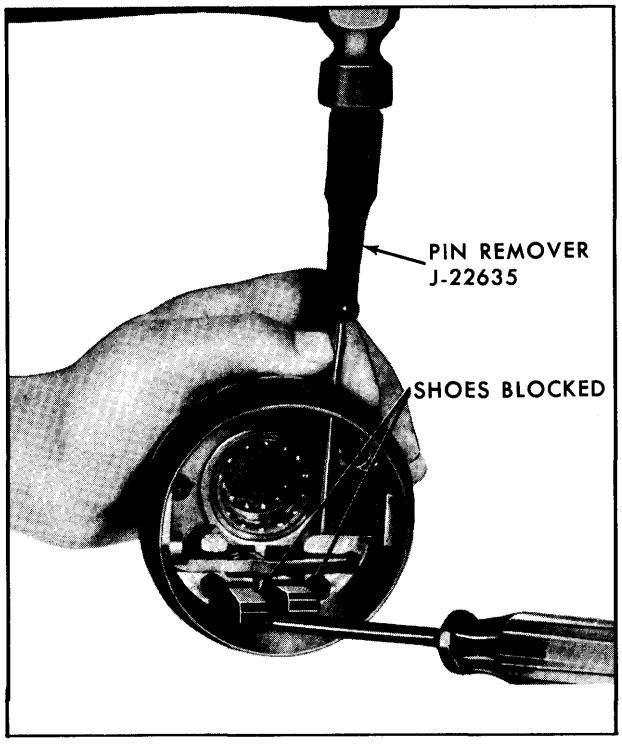


Fig. 9-93 Removing Release Mechanism

signal lever and opening shield from housing, Fig. 9-92.

2. Remove lock bolt spring by removing spring retaining screw. Then, turn spring clockwise and remove spring from bolt.

3. Remove snap ring from sector drive shaft. Using a small punch, lightly tap drive shaft out of sector.

4. Remove drive shaft, sector and lock bolt.

5. Remove rack and rack spring.

6. Wedge shoes inward with a block between top of the shoes, and bearing housing. Using Pin Remover, J-22635, through slot in opposite side of housing, with flat on tool over shoulder next to pin, drive release lever pin out of bearing housing, Fig. 9-93. Remove Pin Remover, J-22635, and remove release lever and spring.

7. Using Pin Remover, J-22635, drive out lock shoe pin. Carefully remove pin remover and remove lock shoes and springs.

(NOTE: With tilt lever opening on left side and shoes facing up, the four slot shoe is on the left.)

e. Inspection

1. Inspect all bearings for wear, roughness and binding. Replace as required.

2. Inspect centering sphere for nicks, damage, and wear. If damage is evident, replace centering sphere.

3. Inspect bearing surfaces of upper shaft for brinelling, nicks, scratches, and wear.

4. Inspect rubber bumpers, making certain they are not torn or damaged.

5. Inspect telescoping mechanism for wear in keyway.

6. Inspect all threads and splines for damage.

7. Inspect locking rod for straightness.

8. Inspect shift bowl for cracks.

9. Inspect steering shaft, shift tube, and outer jacket for signs of damage.

(NOTE: If collapse joint between upper and lower jacket shows movement or is loose, the outer jacket assembly must be replaced.)

10. Inspect all other parts for damage and wear. Replace if necessary.

f. Upper Housing Assembly

1. Apply a thin coat of lithium base (spherical joint) grease or equivalent to all friction parts.

2. Using Pin Remover, J-22635, to line up shoes, install lock shoe springs and lock shoes in upper housing and retain with pin.

(NOTE: With tilt lever opening in housing on left side, and shoes facing up, the four slot shoe is on the left.)

3. Wedge shoes inward with a block between top of shoes and bearing housing. Install spring, release lever, and pin in bearing housing. Remove block from shoes.

4. Install drive shaft in housing, then lightly tap sector onto the shaft far enough to install snap ring. Install snap ring.

5. Install lock bolt and engage sector cam surface.

6. Install rack spring and rack.

(NOTE: Block tooth on rack must engage block tooth on sector.)

7. Install lock bolt spring with "U" shaped arm of spring in the large cavity of the sector and the single wire arm attached to the lock bolt. Install spring retaining screw and tighten to 35 inch-pounds.

8. If removed, install shift lever spring in bowl by winding spring up with pliers and pushing in.

9. Install tilt lever opening shield and turn signal lever opening shield into housing, Fig. 9-92.

g. Shift Tube Installation (On Bench)

1. Install part of Shift Tube Installer, J-23073, in shift tube, Fig. 9-94.

2. Position shift bowl on steering column.

3. Position wave washer in shift bowl.

4. Install plate lock in shift bowl.

CAUTION: Plate lock can be installed backwards by mistake. When installing plate, make sure long flat edge of plate is down and that the long tab is

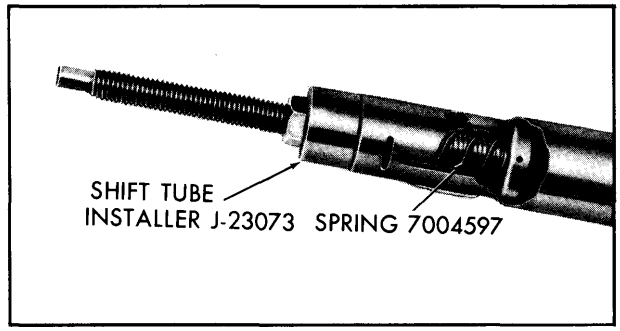


Fig. 9-94 Installing Shift Tube Installer

BACK TO INDEX

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toward shift lever. This will position the two closely spaced holes to bottom of bowl and the larger spaced holes to the top.

5. Using a grease pencil, locate shift tube key on upper face of Shift Tube Installer, J-23073.

6. Slide shift tube up and into column from lower end of column aligning with keyway in shift bowl.

7. Using alignment marks on Shift Tube Installer, J-23073, align shift tube key with keyway in shift bowl and install remaining parts of Shift Tube Installer, J-23073, Fig. 9-95.

8. Tighten nut on Shift Tube Installer, J-23073, and install shift tube, Fig. 9-95.

CAUTION: When installing shift tube, make sure transmission linkage lever on lower end of tube is centered in slot in lower end of steering column jacket.

9. Remove Shift Tube Installer, J-23073.

10. Install thrust washer on upper end of shift tube.

11. Install snap ring on upper end of shift tube. Snap ring is installed when notches are engaged.

h. Steering Shaft and Support Assembly – Installation

1. Install support assembly by aligning "V" in support with "V" notch in jacket and install four screws securing support assembly to plate lock. Tighten screws to 60 inch-pounds. *See CAUTION on Page 9-27.*

2. Install sphere in upper yoke.

CAUTION: Make sure lash take-up spring (horse-shoe in shape) is properly positioned between spheres before assembling to upper yoke.

3. Rotate centering sphere so that lower steering shaft can be installed over flats on sphere (approximately 90° from center line of upper portion of shaft.) Then install lower shaft coupling over the sphere. Looking along shaft from top make sure keyway faces right when flat on lower shaft splines is facing up. If parts are mispositioned, turn signals will not cancel after turn signal is used for lane changing.



Fig. 9-95 Installing Shift Tube

4. Install steering shaft in upper end of column.

CAUTION: If back-up switch was not removed, be careful not to hit switch drive tang with end of shaft as breakage may result.

5. Install bearing and bearing adapter in lower end of steering column jacket.

6. Install cup over lower end of steering column jacket and install lower steering shaft bearing retainer clip.

i. Housing Cover, Lock Cylinder, Ignition Switch and Back-Up Light Switch – Assembly

1. Pull up on tilt lever and install upper housing assembly with lock bolt toward top.

2. Install actuator rod in rack in housing assembly.

3. Guide actuator rod through shift bowl while positioning housing assembly on support assembly. Extend rack as far as possible and engage actuator rod.

4. Pull back on tilt lever and engage tilt shoes in support assembly.

5. Align pivot pin holes and install pivot pins by hand, then tap them in with a plastic mallet. The column must be supported to prevent any bending forces on the collapse area.

6. If removed, install upper bearing in housing assembly.

7. Install upper bearing inner race and retainer ring.

8. Tilt housing to full up position.

9. Position tilt spring guide, tilt spring, and spring retainer in housing assembly.

10. Using a large screwdriver, press in on tilt spring retainer, compress spring and rotate retainer clockwise until retainer locks in housing.

11. Remove tilt release lever.

12. Position turn signal wiring harness inside steering column cover and insert harness into housing until connector is through shift bowl.

13. Install cover over housing assembly.

14. Check tilt lever and turn signal lever opening shields for proper alignment.

15. Install three screws securing cover to housing assembly. Tighten screws to 110 inch-pounds.

16. Position wedge spring on buzzer switch with formed end of clip around the lower end of switch making the spring bow away from the switch, Fig. 9-84.

17. Push switch and spring into hole in housing with switch contacts pointing up, making sure that switch is fully installed.

18. Install hazard warning lever in turn signal switch.

19. Finish installing turn signal switch by feeding harness connector through housing, Fig. 9-82.

20. Position turn signal switch in neutral position and install three screws securing switch to upper housing, Fig. 9-81. Tighten screws to 28 inch-pounds.

(NOTE: When properly installed, cancelling springs should be equal distance from steering shaft. If they are

BACK TO INDEX

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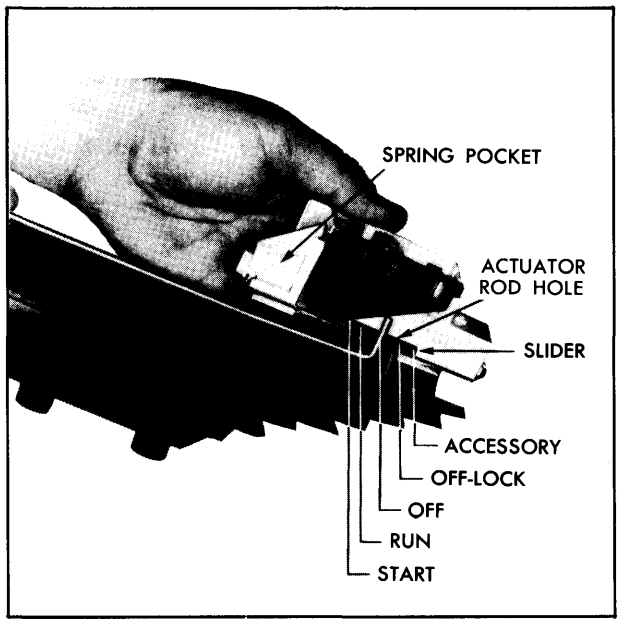


Fig. 9-96 Installing Ignition Switch-T & T Column

not, one turn signal will not cancel when column is reinstalled on car.)

21. Install hazard warning flasher button and check operation.

22. Assemble ignition switch on actuator rod, Fig. 9-96.

CAUTION: When replacing or adjusting ignition switch:

1. *Be sure battery is disconnected.*
2. *Set swtich in OFF-UNLOCKED.*
3. *Put gearshift in "N".*
4. *Turn key toward LOCK and hold while installing switch.*
5. *Re-install column and assure that lever moves freely from "P" to "L".*
6. *Re-connect battery cable.*
7. *Apply service brake and assure that engine starts in "P" and "N", but not in "R", "D", or "L".*

If either the ignition switch or column jacket is replaced, any "witness" marks Fig. 9-13, on the switch bracket must be removed by flattening and the ignition switch adjusted per the above procedure.

CAUTION: Always check the start system as directed on the instruction label before releasing the vehicle.

23. To install lock, hold lock cylinder sleeve and rotate key clockwise against stop. Make sure buzzer switch drive tang is below O.D. of lock cylinder. Insert cylinder into cover bore with key on cylinder sleeve aligned with keyway in housing until cylinder touches lock sector shaft.

(NOTE: A 1/16" drill shank gage must be inserted between the lock cylinder knob and the column housing to avoid assembling the lock cylinder into the column beyond its normal position.)

24. Maintaining a light push inward on cylinder, rotate cylinder counterclockwise until drive section of cylinder mates with sector drive shaft. Push in until snap ring on lock cylinder pops into groove in housing. Check freedom of rotation of lock cylinder in housing. There must be a free spring return from start to run position.

25. Install turn signal lever.

(NOTE: On cars equipped with Cruise Control, proceed as follows:)

a. Attach guide wire to Cruise Control switch harness connector.

b. Insert harness connector in opening in steering column cover.

c. Gently pull part of harness down through steering column cover part way.

d. Allow turn signal lever to hang free, with approximately 16" of wire out of column. Then rotate turn signal lever in a counterclockwise direction six times, permitting Cruise Control harness to make six loops.

e. Insert turn signal lever into opening in column.

f. Screw turn signal lever into position, passing the Cruise Control harness over the turn signal lever each time one full turn of the lever is completed.

CAUTION: The harness must be passed over the lever each time the lever makes one complete turn to prevent damaging harness where it enters into the turn signal level. The wire loops will unwind as the lever is screwed in and wires will be straight in the column. Turn lever tight by hand then use a 5/16" wrench to tighten until recess in turn signal lever is facing toward bottom of column.

g. After lever is installed, gently pull remainder of harness through column and into position.

h. Remove guide wire from Cruise Control harness.

i. Install harness protector on harness and slide protector up harness and into position.

j. Connect Cruise Control harness to connector.

26. Attach connector to column.

27. Install upper steering shaft preload spring.

28. Install lock plate and carrier assembly.

(NOTE: When installing lock plate and carrier assembly, make sure flat on lower end of steering shaft is pointing up and that the small plastic tab on the carrier is up or nearest the top of the shift bowl. Flat surface of lock plate must be installed facing down (against turn signal switch.)

29. If upper end of upper shaft hub was removed, replace shaft and wedge at this time.

30. Install Spring Compressor, J-23063, Fig. 9-89. Compress preload spring and lock plate and install C-ring with wide side toward keyway.

31. Remove Spring Compressor, J-23063.

32. Insert plastic retainer on C-ring.

33. Position turn signal switch harness protector over weld nut on upper steering column jacket.

34. Position steering column upper mounting bracket over turn signal wiring harness protector and secure bracket to column with four screws and washers. Tighten screws to 20 foot-pounds.

BACK TO INDEX

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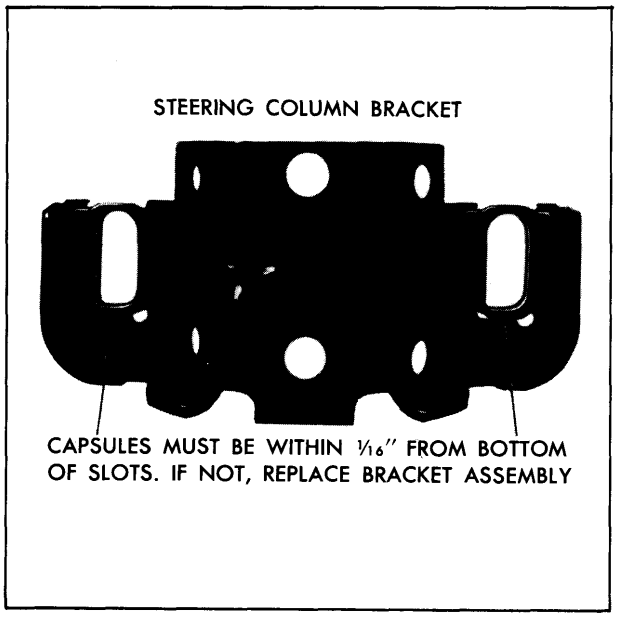


Fig. 9-97 Checking Capsules in Bracket

35. Remove tape from turn signal switch wiring harness and connector.

36. Connect turn signal harness to connector and install connector in bracket on steering column jacket.

37. Slide rubber sleeve bumper over steering shaft.

38. Install and adjust back-up light switch as outlined in section 12, Note 35b.

39. Install steering wheel as described in Note 26b.

32. Checking Steering Column for Accident Damage

(NOTE: Cars involved in accidents resulting in frame damage, major body or sheet metal damage, or where the steering column has been impacted may also have a damaged or misaligned steering column.)

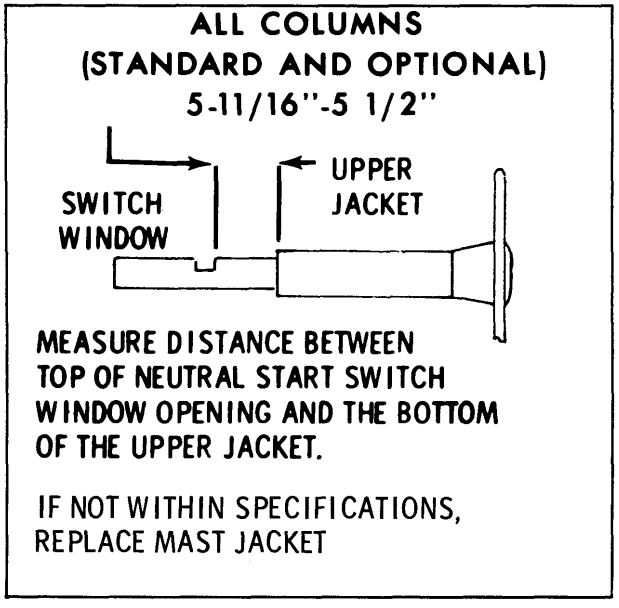


Fig. 9-98 Checking Mast Jacket For Collapse

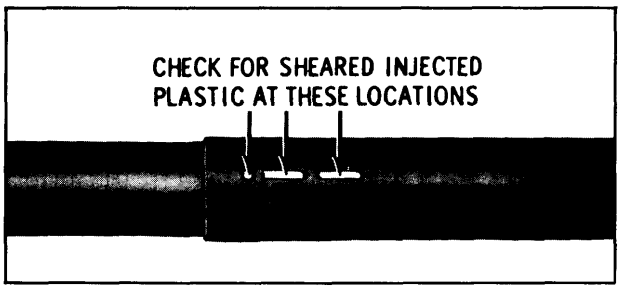


Fig. 9-99 Checking Shift Tube Injected Plastic

CHECKING PROCEDURE

1. Check capsules on steering column bracket assembly; all should be within 1/16" from the bottom of the slots Fig. 9-97. If not, bracket should be replaced.

2. On standard column, check operation of the shift lever. If you are able to move lever to "Park" position without raising lever, it is an indication that the upper shift tube plastic bearing is broken.

3. Check for mast jacket collapse by measuring the distance from edge of the neutral-start switch window to the lower edge of upper jacket. Refer to Fig. 9-98 for dimensions. If mast jacket dimensions Fig. 9-98, are not within specifications a NEW mast jacket must be installed and shift tube and steering shaft visually inspected for sheared injected plastic. If shift tube shows sheared plastic a NEW shift tube must be installed. Fig. 9-99. If steering shaft shows sheared plastic and not bent, it can be repaired by using a Service Steering Shaft Repair Kit. Kit contains instructions and dimensions for all steering shafts, Fig. 9-100.

4. Check for broken plastic bearing adapter at lower end of steering shaft. If adapter is cracked or broken, it must be replaced.

5. Check steering gear flexible coupling for tears or for no pin engagement. This indicates possible misalignment or frame damage. If flexible coupling damage is evident, the coupling is to be replaced.

6. Any frame damage that could cause a bent steering shaft must have steering shaft runout checked in the following manner: Disconnect the lower shaft at flex-coupling, then remove bolt and nut from clamp of coupling assembly. Remove lower shaft. Hold ruler against lower end of steering shaft and have steering wheel rotated. Runout must not exceed 1/16". Dial indicator may be used instead of a ruler.

(NOTE: This check cannot be made if the bearing adapter is broken.)

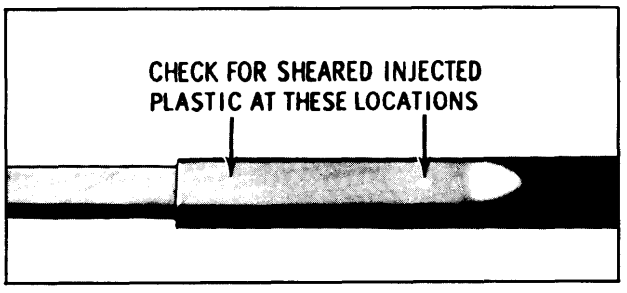


Fig. 9-100 Checking Steering Shaft Injected Plastics

BACK TO INDEX

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ELDORADO STEERING

The service information that follows pertains only to the Eldorado. All other descriptions, service procedures and recommendations for the Eldorado are the same as those for other cars as given in the first part of this section.

Steering Linkage—Eldorado

The steering linkage on the Eldorado, Fig.9-101, consists of a pitman arm, idler arm, two tie rod assemblies, a one piece forged steel drag link, and a shock absorber. The pitman arm connects the left side of the drag link to the steering gear and the idler arm connects the right side of the drag link to the frame. The shock absorber connects the drag link to the frame in such a manner as to dampen vibrations in the linkage. The tie rods serve as connecting links between the drag link and the steering knuckles. Tie rod ends should be checked for looseness and damaged seals. Loose tie rod ends must be replaced as a unit. Tie rod seals are replaceable and any damaged seals should be replaced. Four lubrication fittings have been added to the tie rod ends.

33. Steering Gear—Eldorado (Fig. 9-102)

a. Removal

1. Disconnect pressure and return lines from gear. Cap or tape line fittings.
2. Raise car.
3. Remove cotter pin and nut at pitman arm.
4. Disconnect pitman arm from drag link using Puller, J-24319, Fig. 9-103.
5. Remove two plastic retainers securing flexible coupling shield to frame side rail and remove shield. Discard retainers.
6. Remove two nuts and lockwashers holding flexible coupling together.
7. Remove three screws that hold steering gear to frame side rail, move steering gear forward and downward out of car.
8. Working on bench, remove pitman shaft nut and lockwasher and remove pitman arm from pitman shaft using Pitman Arm Puller, J-6632.

(NOTE: If mounting threads are stripped, do not repair. Replace Housing.)

b. Installation

See CAUTION on Page 9-27 when performing steps 1, 2 and 4.

1. Place pitman arm on pitman shaft and install lockwasher and nut on pitman shaft. Tighten nut to 185 foot-pounds.
2. Position steering gear on car and secure to frame side rail with three screws and flatwashers. Tighten screws to 70 foot-pounds.
3. Install nuts and lockwashers that hold flexible coupling together. Tighten nuts to 20 foot-pounds.
4. Install flexible coupling shield to frame side rail and secure with two new plastic retainers.
5. Install drag link to pitman arm and secure with nut and cotter pin. Tighten nut to 60 foot-pounds and install cotter pin.

(NOTE: If cotter pin cannot be installed, tighten nut to next hole location and install cotter pin.)

6. Uncap pressure and return line hoses and connect to steering gear. Tighten nuts to 30 foot-pounds.
7. Check fluid as outlined in Note 1.

WARNING: WHEN HOSES ARE RECONNECTED BE SURE HOSES DO NOT TOUCH WHEEL HOUSING OR HOSES MAY BECOME CHAFED AND RUPTURE.

34. Idler Arm—Eldorado

a. Removal

1. Raise car on hoist.
2. Remove cotter pin from idler arm stud and remove nut.

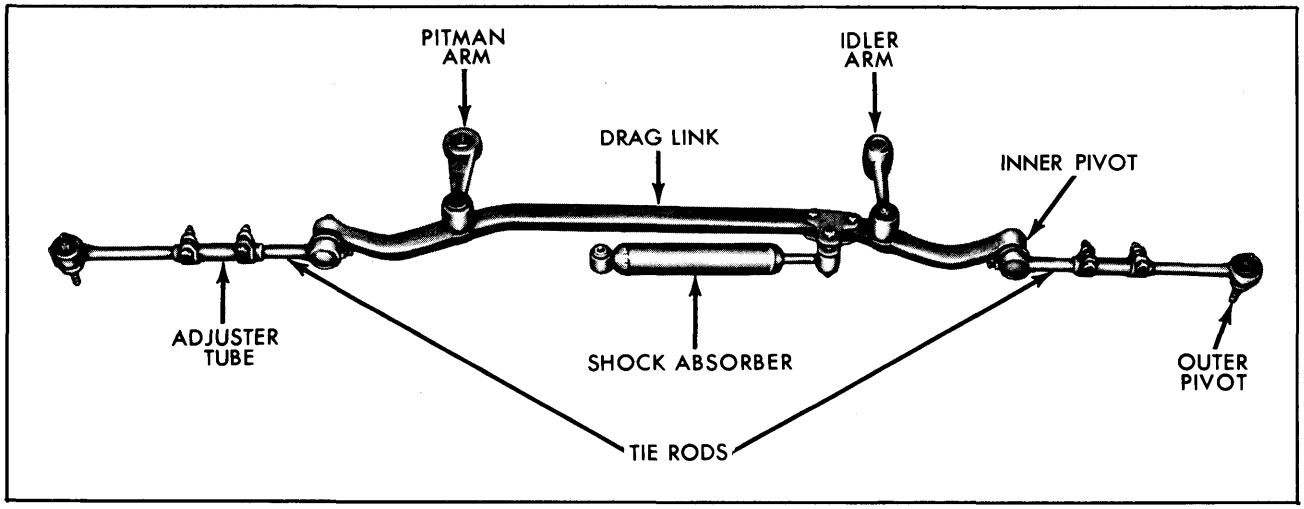


Fig. 9-101 Steering Linkage Eldorado

BACK TO INDEX

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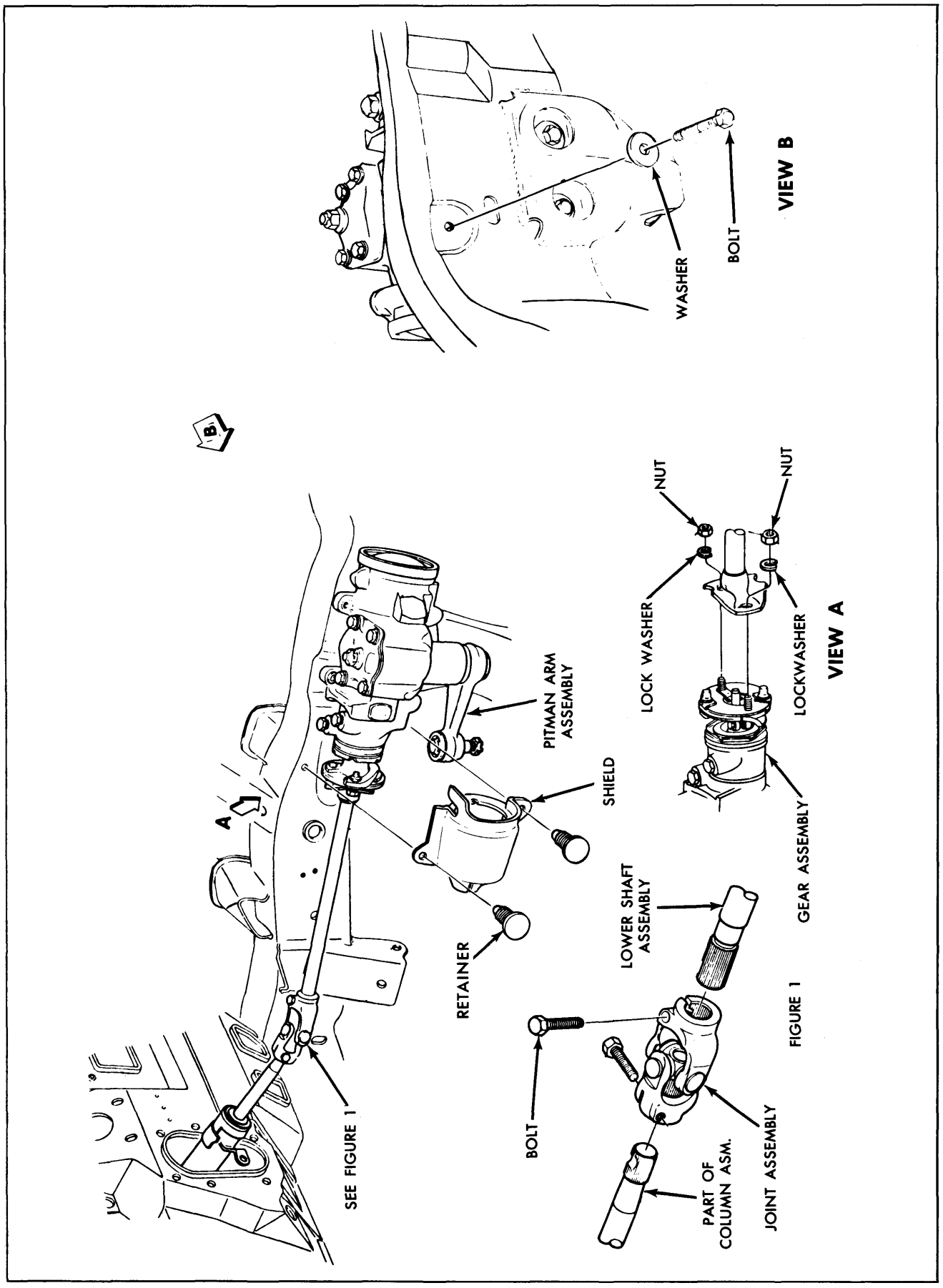


Fig. 9-102 Steering Gear Installation

BACK TO INDEX

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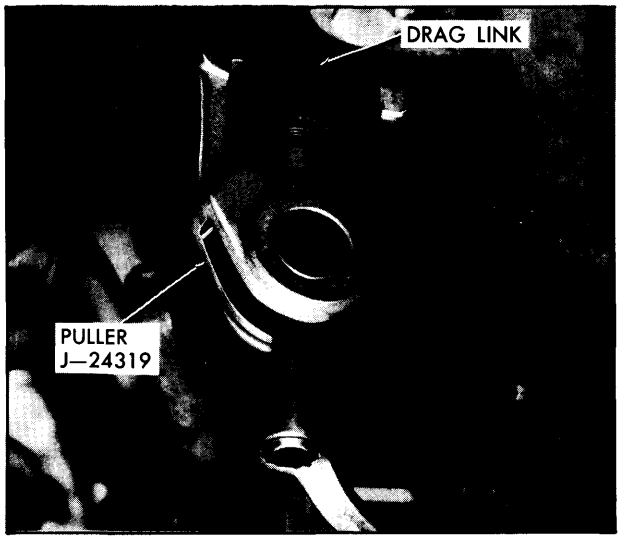


Fig. 9-103 Disconnecting Pitman Arm-Eldorado

3. Remove nut and bolt securing idler arm to frame cross member bracket.
4. Remove idler arm from drag link using Puller J-24319.

b. Installation

1. Install idler arm to drag link and secure with nut. Tighten to 60 foot-pounds and install cotter pin.
2. Install idler arm in frame cross member bracket and secure to bracket with nut and bolt. Tighten to 95 foot-pounds.
3. Lower car.

35. Pitman Arm—Eldorado

a. Removal

1. Remove two plastic retainers securing flexible coupling shield to frame side rail and remove shield. Discard retainers.
2. Remove nuts and washers securing flexible coupling.
3. Raise car.
4. Remove pitman shaft nut and washer. Mark position of arm to shaft.
5. Remove cotter pin from pitman arm to drag link stud and remove nut.
6. Disconnect stud from drag link using Puller J-24319.
7. Remove screw securing cooler lines to front cross member.
8. Remove the three steering gear to frame bolts and position gear forward and up far enough to attach Pitman Arm Puller J-6632. Remove pitman arm from shaft.

b. Installation

1. Install pitman arm on ptiman shaft and torque nut to 185 foot-pounds. Loosely fit pivot in to drag link.
2. Install flexible coupling flange into steering shaft flange, loosely install nuts and washers. Check steering wheel and pitman shaft for center on gear.
3. Install steering gear to frame mounting bolts. Tighten to 70 foot-pounds.
4. Tighten pitman arm stud nut to 60 foot-pounds and install cotter pin.
5. Tighten flexible coupling flange nuts to 20 foot-pounds.
6. Secure cooler lines to front cross member with screw.
7. Lower car.
8. Install flexible coupling shield and secure with new plastic retainers.

36. Lower Steering Shaft (Fig. 9-104)

a. Removal

1. Remove two plastic retainers securing flexible coupling shield and remove shield.
2. Remove two nuts and lockwashers and bolts holding flexible coupling together.
3. Remove screw holding flexible coupling to steer-

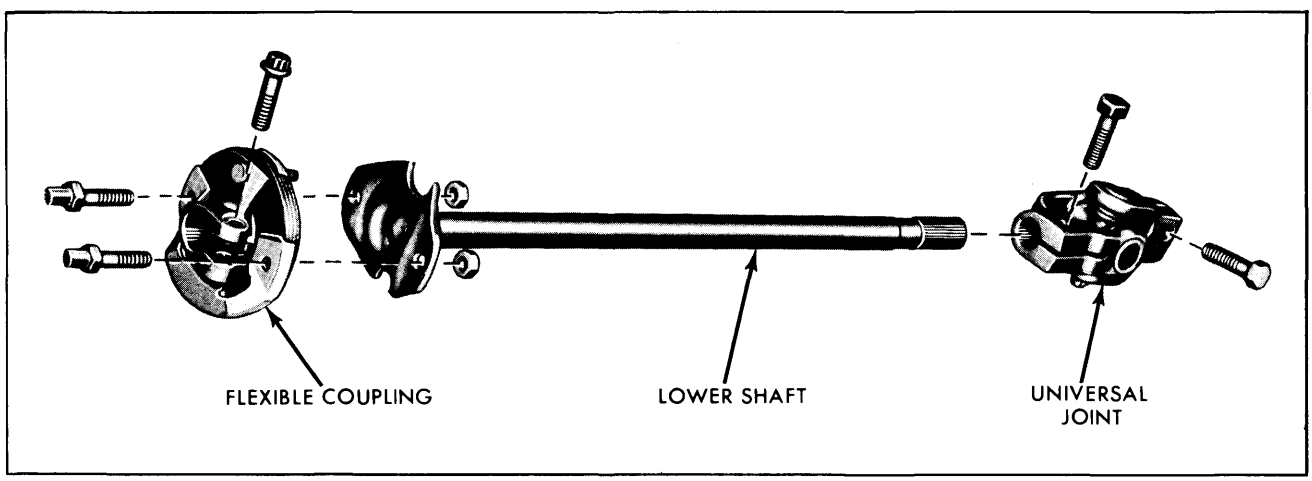


Fig. 9-104 Lower Steering Shafts

BACK TO INDEX

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ing gear and shift portion of flexible coupling on gear away from flange on shaft.

4. Disengage flange on shaft from flexible coupling.

5. Remove screw securing universal joint to lower steering shaft and remove shaft from universal joint.

b. Installation

See CAUTION on page 9-27 when performing steps 1, 2, 5 and 6.

1. Insert lower steering shaft into universal joint aligning split in universal joint with flat on shaft. Secure with screw tightened to 80 foot-pounds.

2. Engage flange on shaft to flexible coupling on gear and secure with two bolts, lockwashers and nuts. Tighten nuts to 20 foot-pounds.

3. Install screw securing flexible coupling to steering gear. There should be at least .040 inch clearance between coupling and adjuster plug. Tighten screw to 30 foot-pounds.

4. Install flexible coupling shield and secure with two plastic retainers.

37. Eldorado Lower Steering Shaft — A.C.R.S. Only

A two piece lower steering shaft, Fig. 9-104 is used on Eldorados equipped with the Air Cushion Restraint System; the same as in 1975.

1. Check for lower steering shaft collapse by measuring as shown in Fig. 9-105.

2. If the shaft measures less than 6-1/8 inches, replace the lower shaft.

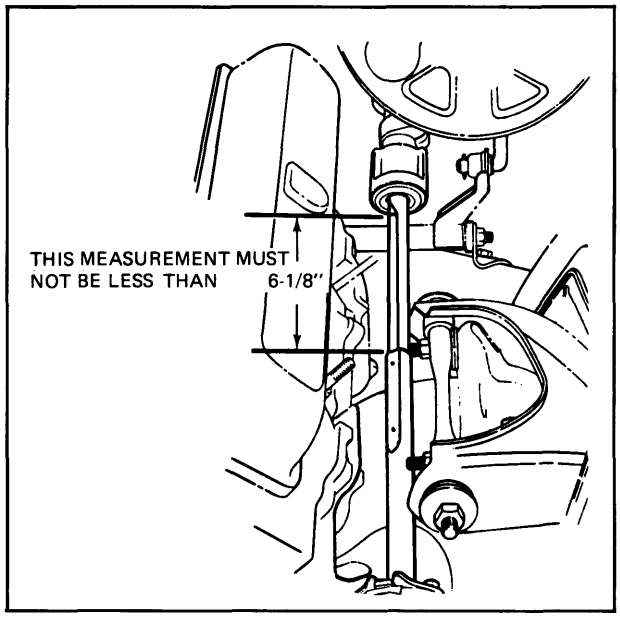


Fig. 9-105 Checking Lower Shaft For Collapse

38. Steering Linkage Removal, Disassembly, Assembly, and Installation—Eldorado

a. Removal

1. Remove front wheels.

2. Remove bolt securing steering shock absorber to bracket on frame.

3. Remove cotter pins and nuts from pitman arm and idler arm pivots on drag link.

4. Remove idler and pitman arm pivots from drag link using Puller, J-24319, Fig. 9-103.

(NOTE: It may be necessary to loosen steering gear at frame to remove drag link from pitman arm.)

5. Remove cotter pins and nuts from outer tie rod pivots at steering knuckles.

6. Remove tie rod pivots from steering knuckles using Tie Rod End Puller, J-24319.

7. Remove linkage from car.

8. Remove bolt and locknut securing idler arm to frame and remove idler arm from car.

b. Disassembly

1. Remove cotter pins and nuts from inner tie rod pivots.

2. Remove tie rods using Tie Rod End Puller, J-24319.

3. Remove outer tie rod pivots by loosening nuts on outer clamp bolts and unscrewing pivots from adjuster tube.

4. Loosen nuts on inner clamp bolts and unscrew tie rod inner pivots from adjuster tubes.

5. Remove bolts securing damper to bracket on drag link and remove damper and spacer.

c. Assembly

1. Position steering damper and spacer to brackets on drag link. Spacer should be positioned between damper attachment and upper part of bracket.

2. Attach damper to bracket with bolt and tighten to 40 foot-pounds.

3. Lubricate adjuster tube with chassis lubricant, install adjuster tubes and clamps on tie rod inner pivots.

4. Thread tie rod outer pivots into adjuster tubes.

(NOTE: An equal amount of thread must be exposed on both ends of the adjuster tubes.)

5. Install both tie rods on drag link, tighten nuts to 60 foot-pounds and install cotter pins. If cotter pin cannot be installed, tighten nut to next hole location and install cotter pin.

See CAUTION on page 9-27.

d. Installation

See CAUTION on page 9-27 when performing steps 1, 2 and 3.

1. Install idler arm on frame with bolt and locknut. Tighten bolt to 95 foot-pounds.

BACK TO INDEX

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2. Install drag link on pitman arm and idler arm pivots and tighten pivot nuts to 60 foot-pounds. Install cotter pins.

3. Install outer tie rod pivots to steering knuckles and tighten nuts to 37 foot-pounds. Install cotter pins.

(NOTE: If holes do not line up, continue to tighten nut until cotter pin can be inserted. Do not tighten nut more than 50 foot-pounds.)

4. Install shock absorber to frame bracket, tighten bolt to 40 foot-pounds.

5. Install front wheels on car.

6. Adjust alignment as described in Section 3, Note 20.

39. Drag Link Height Adjustment—Eldorado

Drag link height and parallelism should be checked in cases of steering wander and instability after normal correcting adjustments such as standing height, front wheel alignment, etc., have been made. Check drag link height by measuring distance between lower edge of drag link, just inboard of tie rod inner pivots, and centerline of lower control arm inner pivot bolts. The procedure outlined below may be used to measure these distances.

1. Position car on wheel alignment machine. Place a straight edge midway between drag link and lower control arm and front inner pivots across a level parallel surface, see Fig. 9-106.

2. Measure distance "A" from center line of control arm pivots to top of straight edge.

3. Measure distance "B" from drag link (just inboard of inner pivots) to top of straight edge.

4. The difference between distance "B" and distance "A" should be the same left side to right within 1/8".

5. If not parallel or within 1/8", loosen gear mounting bolts and rotate gear in proper direction to obtain proper height. Tighten mounting bolts to 70 foot-pounds.

See CAUTION note on Page 9-27.

6. If proper height cannot be obtained pry drag link as follows:

a. If the drag link needs to be lowered on the right side install a short piece of chain around the intermediate rod between the right inner pivot and steering damper mounting bolt, see Fig. 9-106. Pry downward with a long bar until proper height is obtained.

b. If the drag link needs to be raised on the right side place the bar under the drag link and pry up, see Fig. 9-106.

7. Adjust front wheel toe in to zero left and right. Center steering wheel with tie rod adjusters.

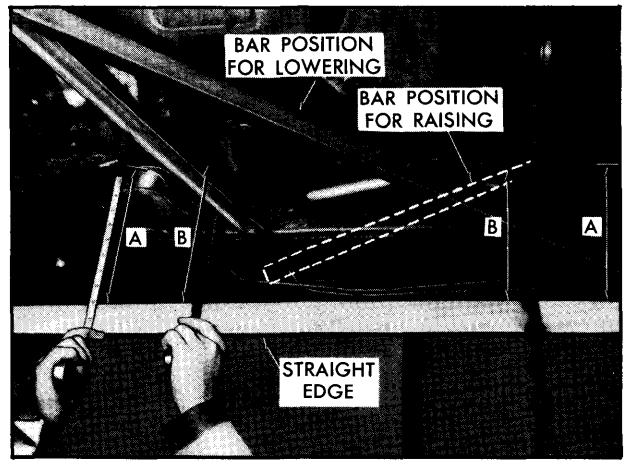


Fig. 9-106 Steering Linkage Parallelism-Eldorado

BACK TO INDEX

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TORQUE SPECIFICATIONS

Material Number	Application	Thread Size	Foot-Pounds
280M	Mounting Bracket to Pump Screw	3/8-16	32
Special	Pump Pressure Unions	5/8-18	32
286M	Pump Pulley Nut	9/16-18	47
260M	Pump Mounting Bracket to Engine Screw	3/8-16	22
*260M	Flexible Coupling Upper Clamp Screw	3/8-24	30
*280M	Flexible Coupling Lower Clamp Screw	3/8-24	30
*286M	Flexible Coupling Nut	5/16-24	20
*286M	Flexible Coupling Nut	3/8-24	20
*300M	Universal Joint Clamp Bolt (Eldorado)	7/16-20	80
Special	Rack-Piston End Plug	1-5/16-16	80
Special	Rack-Piston Ball Guide Clamp Screw	1/4-20	10
280M	Steering Gear Side Cover Screws	3/8-16	45
*300M	Steering Gear to Frame Screw	7/16-14	55
*300M	Steering Gear to Frame Screw (Eldorado)	7/16-14	70
Special	Steering Gear Adjuster Lock Nut	7/16-20	32
*Special	Pitman Shaft Nut	7/8-14	185
*Special	Pitman Arm to Drag Link Nut	1/2-20	45
*Special	Pitman Arm to Drag Link Nut (Eldorado)	1/2-20	60
*Special	Idler Arm to Drag Link Nut	1/2-20	40
*Special	Idler Arm to Drag Link Nut (Eldorado)	1/2-20	60
*Special	Inner Tie Rod Pivot to Drag Link Nut	1/2-20	60
*280M	Idler Arm to Frame Bolt	3/8-24	35
*Special	Tie Rod Adjuster Clamp Nut	3/8-24	22
*Special	Tie Rod Pivot to Steering Knuckle Nut	1/2-20	37
*Special	Tie Rod Pivot to Steering Knuckle Nut (Eldorado)	1/2-20	37
Special	Upper Mounting Bracket to Steering Column Screw	5/16-18	20
*301M	Steering Wheel Nut	9/16-18	30
*280M	Idler Arm to Frame Bolt (Eldorado)	5/8-11	95
*280M	Steering Shock Absorber to Frame or Bracket Bolts (Eld.)	7/16-14	40
*300M	Steering Shock Absorber Bracket to Drag Link Bolt (Eld.)	5/16-18	17
*301M	Steering Shock Absorber Bracket to Drag Link Nut	5/16-18	17
Special	Upper Mounting Bracket to Dash Support Screw	5/16-18	20
			Inch-Pounds
6010M	Turn Signal Lever Screw	#8-32	20
Special	Lower Mounting Bracket Clamp Screw	5/16-18	48
1020	Tilt and Telescope Support Screws	#12-28	50
Special	Lower Mounting Bracket to Toe Pan Screws	5/16-18	38
Special	Ignition Switch to Jacket		35

(NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings and steel classification.)

**CAUTION: This fastener is an important attaching part in that it could affect the performance of vital components and systems, and/or could result in major repair expense. It must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.*

BACK TO INDEX

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SPECIAL TOOLS

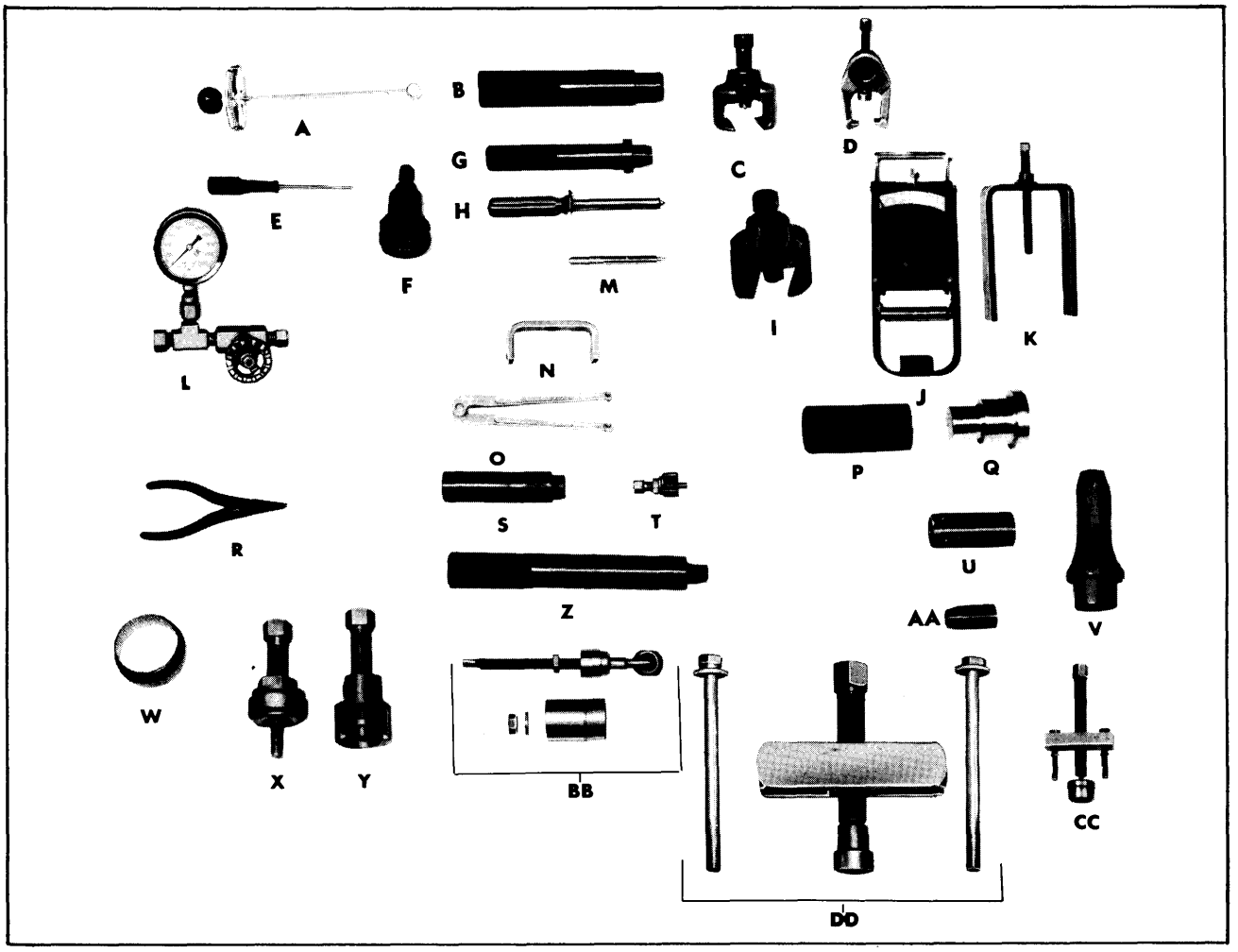


Fig. 9-107 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-7754	Torque Wrench (0-25 inch-pounds)	R	J-4245	Snap Ring Pliers
B	J-6657	Pitman Shaft Bearing Remover	S	J-6221	Adjuster Plug Bearing Remover and Installer
C	J-9172	Pitman Arm Puller (C-Car)			
D	J-24319	Front Suspension Puller	T*	J-21854-01	Hardened Step Screw and Pivot Pin Adapter
E*	J-22635	Pin Remover			
F	J-21883	Pump Pulley Puller	U	J-7728	Pump Shaft Oil Seal Installer
G	J-5188	Adjuster Plug Seal Installer	V	J-21150	Seal Installer, Linkage
H	J-21552	Rack-Piston Arbor	W	J-7576	Rack-Piston Seal Compressor
I	J-6632	Pitman Arm Puller (Eldorado)	X	J-25033	Steering Pump Pulley Installer
J	J-23600	Belt Tension Gage	Y	J-25034	Steering Pump Pulley Remover
K*	J-23063	Carrier and Spring Compressor	Z	J-8092	Universal Handle
L	J-5176-01	Pressure Testing Gage Assembly	AA	J-6222	Adjuster Plug Seal Protector
M	6-217	Valve Connector Seat Installer	BB*	J-23073	Shift Tube Installer
N	J-23131	Carrier and Spring Compressor	CC*	J-23072	Shift Tube Remover
O	J-7624	Spanner Wrench	DD	J-1859-03	Steering Wheel Puller
P	J-6219	Pitman Shaft Seal Installer			
Q	J-22407	Pitman Shaft Bearing Installer			

*Denotes Tilt and Telescope column only.

BACK TO INDEX

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WHEEL, VALVE AND FASTENING TABLE

Wheel, Valve, and Fastening Table	Calais, De Ville, and Brougham	Fleetwood Seventy Five Commercial Vehicle	Eldorado
Wheel Size and Flange Type	15x6JK	15 x 6JK	15x6JK
Spider to Rim Attachment	Spot Welded	Riveted	Riveted
Offset (Rim Center Line to Mounting Surface)	.29 In.	.29 In.	3.31 In.
Wheel Identification	SC	SB	SD
Valve Stem	T.R. 413 or T.R. 418	T.R. 413 or T.R. 418	T.R. 417
(Number of Fasteners), Bolt Circle	(5), 5.0 In.	(5), 5.0 In.	(5), 5.0 In.
Fastener Torque	80-100 ft. lbs.	80-100 ft. lbs.	100-130 ft. lbs.

GENERAL DESCRIPTION

Wheels

The wheels used are of steel construction. The center or spider and rim sections are joined together by spot welds or rivets. Wheels are attached with five 1/2-20 right hand thread cone face nuts. Replacement wheels must be equivalent to original equipment wheels in load capacity, diameter, rim width, and offset.

Wheel Maintenance

Wheels must be replaced if they are bent, dented, have excessive lateral or radial runout, leak air through welds, have elongated bolt holes, if lug nuts won't stay tight, or if they are heavily rusted. Wheels with greater runout than shown in Fig. 10-1 may cause objectional vibrations.

Wheel repairs that use welding, heating, or peening are not approved. An inner tube is not an acceptable repair for leaky wheels or tires, as the inner tube could mask a more serious problem.

Wheel nuts must be tightened in sequence and to the specified torque range for proper attaching and to avoid bending wheel, brake drum or rotor, Fig. 10-2. For uniform torque results, the mounting sequence shown should be followed twice. First to firmly seat all nuts and a second time to achieve the recommended torque.

Tires

The tires are designed to operate with loads up to the full rated load capacity, when inflated to the recommended pressures. Correct tire pressures and driving habits have an important influence on tire life. When replacement is necessary, the original equipment type tire should be used. Refer to the Tire Inflation placard on the glove box door.

Tire Size and Load Rating

Tire sizes and load ratings are indicated by a combination of numbers and letters such as LR78-15, load range B. The first letter designates the load the tire will carry at a given inflation pressure. The "higher" the letter, the bigger the tire and so the greater the load capacity. The second letter, R, designates a radial construction. Load range replaces the ply-rating system. Load range B and load range D tires will carry the same load at the same pressure. Load range D tires may be inflated to higher pressures. At the higher pressures they will carry a greater load.

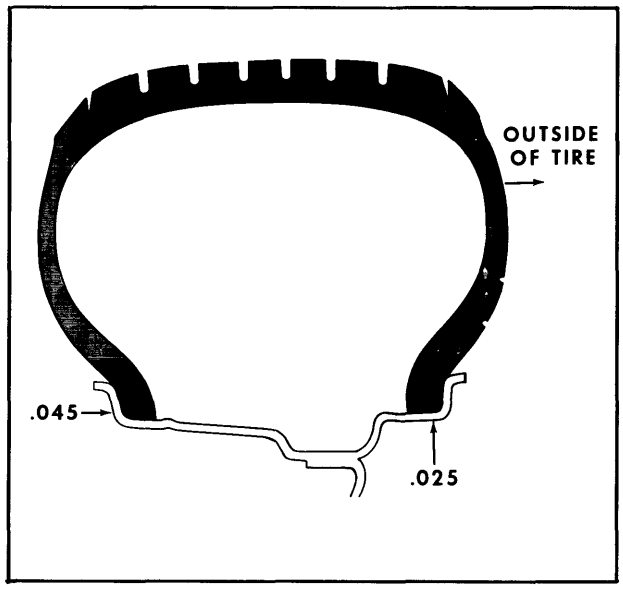


Fig. 10-1 Wheel Run Out

BACK TO INDEX

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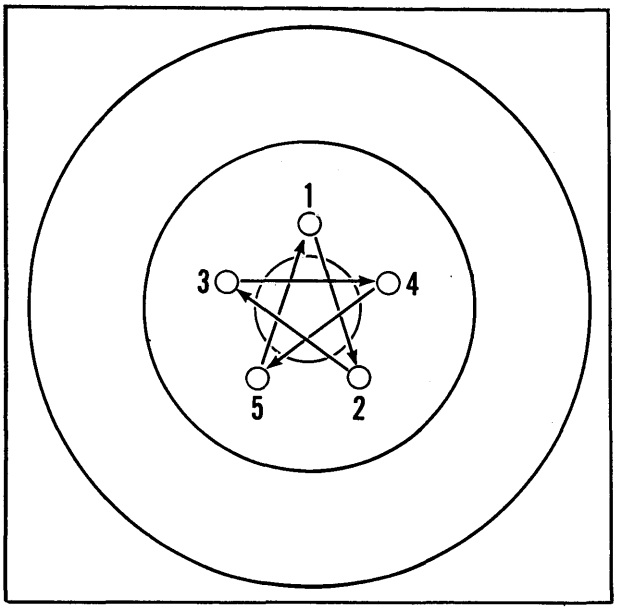


Fig. 10-2 Wheel Mounting Sequence

The first set of numbers (78) denotes the ratio of tire height to width. Height divided by width equals section ratio. For example an LR78 tire is 78 percent as high as it is wide. The lower the number, the wider the tire. The second set of numbers (15) shows the bead diameter of the tire.

A TPC SPEC. NO. (Tire Performance Criteria Specification Number) is molded into the sidewall of each radial tire next to the tire size designation. The TPC number indicates that the tire meets GM size and performance specifications for each specific model.

Inflation of Tires

Correct inflation pressure is an important item of tire care. The pressure recommended for any model is carefully calculated to give a satisfactory ride, handling, tread wear and durability.

- Tire pressure, with tires cold*, should be checked monthly or before any extended trips and set to specifications on the placard label.
- Valve caps or extensions should be on the valve to keep dust and water out.
- For continuous high speed operation (over 75 MPH) increase pressures 4 PSI up to maximum of 32 PSI cold, for load range B tires, and 40 PSI for D rated tires. (Sustained speeds above 75 MPH are not recommended when the 4 PSI adjustment would require pressures greater than maximum.)
- Tire pressures may increase as much as 6 PSI when hot.

*After vehicle has set for 3 hours or more, or driven less than 1 mile.

Higher Than Recommended Pressure Can Cause:

1. Hard ride.
2. Tire damage from impact.
3. Poor traction at rear wheels.
4. Rapid tread wear at center of tire.

Lower Than Recommended Pressure Can Cause:

1. Tire squeal on turns.
2. Higher effort steering.
3. Rapid and uneven wear on the edges of the tread.
4. Tire damage from wheel impacts.
5. Tire cord breakage.
6. Tramp and shimmy.
7. High tire temperatures.
8. Decreased handling capability.
9. Decreased fuel economy.

Unequal Pressure on Same Axle Can Cause:

1. Uneven braking.
2. Steering lead.
3. Poor handling.
4. Swerve on acceleration.
5. Overheating of differential (drive axle).

Use of Tire Chains

Tire chains may be used on the drive wheels of all models equipped with recommended size tires. On models equipped with fender skirts, the skirts should be removed when tire chains are used. It is recommended that vehicles equipped with chains be limited to 45 MPH.

Replacement Tires

When replacing tires, only the size, load range, and construction type (bias, bias-belted, or radial) originally installed on the vehicle are recommended. Use of any other tire size or type tire may seriously affect ride, handling, speedometer/odometer calibration, vehicle ground clearance and tire clearance to the body and chassis. The following also should be considered when replacing tires:

WARNING: DO NOT MIX DIFFERENT TYPES OF TIRES ON THE SAME VEHICLE SUCH AS RADIAL, BIAS, AND BIAS-BELTED TIRES EXCEPT IN EMERGENCIES, BECAUSE VEHICLE HANDLING MAY BE SERIOUSLY AFFECTED AND MAY RESULT IN LOSS OF CONTROL.

- It is recommended that new tires be installed at all positions or in pairs on the same axle.
- When replacing only one tire, it should be paired with the tire having the most tread, to equalize braking traction.

Tire Rotation

To equalize wear, rotate radial tires according to Fig. 10-3. Do not use the X method as roughness and

BACK TO INDEX

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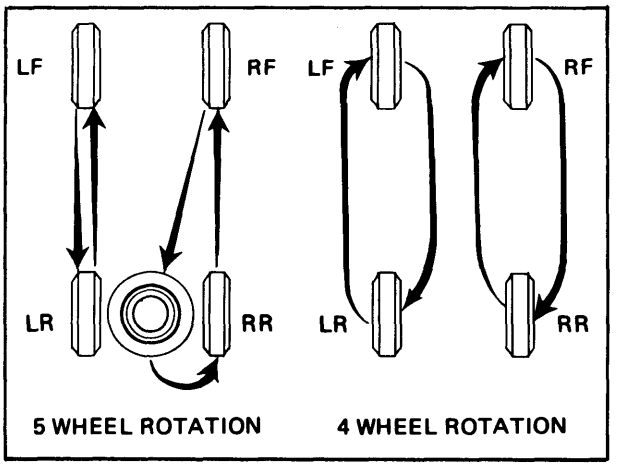


Fig. 10-3 Tire Rotation Diagram

irregular wear can result. Radial tires should be rotated at the first 7,500 miles and then at least every 15,000 miles.

Due to their design, radial tires tend to wear at a faster rate in the shoulder area, particularly in front positions. This makes regular rotation necessary.

There are two rotation plans; one for four tires and one for five tires. See rotation chart Fig. 10-3.

Unusual wear such as flat spots, cups, gouges, and wavy wear, Fig. 10-10, can be caused by loose or neglected suspension or tire balance.

The importance of regular rotation and an occasional alignment check cannot be over-emphasized.

(NOTE: Use 4 wheel rotation only when vehicle is equipped with a stowaway spare.)

SERVICE INFORMATION

1. Tire Demounting and Mounting

Use a tire changing machine to mount or demount tires. Follow the equipment manufacturer's instructions and observe the following:

- Hand tools such as tire irons are not recommended as they may damage the tire beads or wheel rim.
- Wheel bead seats should be cleaned with a wire brush or coarse steel wool to remove lubricants, old rubber, and light rust.
- After inflating, check the locating rings of the tire to be sure they show around the rim flanges on both sides.

WARNING:

- **DO NOT STAND OVER TIRE WHEN INFLATING. BEAD MAY BREAK WHEN BEAD SNAPS OVER SAFETY HUMP AND CAUSE SERIOUS PERSONAL INJURY.**
- **DO NOT EXCEED 40 PSI PRESSURE WHEN INFLATING. IF 40 PSI PRESSURE WILL NOT SEAT BEADS, DEFLATE, RELUBRICATE AND REINFLATE. OVERINFLATION MAY CAUSE THE BEAD TO BREAK AND CAUSE SERIOUS PERSONAL INJURY.**

2. Tire Repair

Punctured tires should be removed from the wheel and permanently repaired from the inside. (Follow tire manufacturer's recommendations.)

The tire industry recommends that punctures in the tread area up to 1/4" in diameter can be repaired, Fig. 10-4. A head type of plug or a combination of a plug and patch repair is recommended as it not only patches the injury from the inside, but it also plugs the hole to keep dirt and moisture from working into the tire body. Externally-applied plug type repairs should be considered temporary and the tire should be permanently repaired as soon as possible.

a. Never Repair a Tire Which Has:

- A bulge or separation.
- Broken beads.
- Loose cords.
- Cracks or cuts extending into the fabric.
- Tires with tread wear indicators showing.
- Puncture larger than 1/4" in diameter or outside the recommended repair area.

b. Stowaway Spare

Stowaway spare service is only to be performed by an authorized outlet of the tire manufacturer.

3. Balancing Wheels

There are two types of wheel balancing – static and dynamic. Static balance is the equal distribution of weight around the wheel. Wheels that are statically

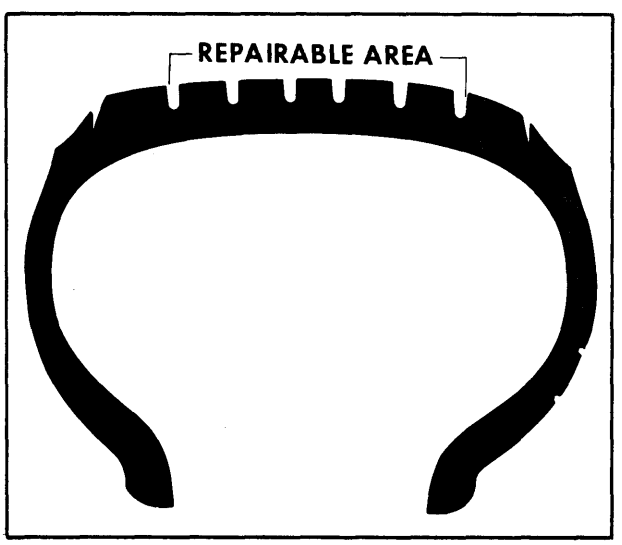


Fig. 10-4 Tire Repairable Area

BACK TO INDEX

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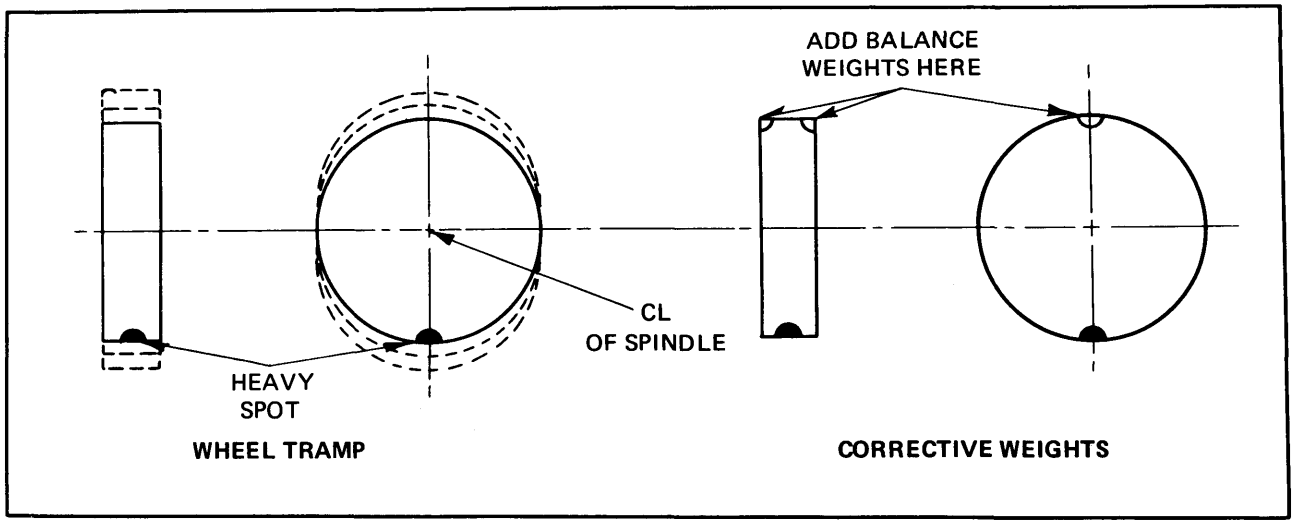


Fig. 10-5 Static Unbalance Correction

unbalanced cause a bouncing action called wheel tramp. This condition will eventually cause uneven tire wear, Fig. 10-5.

Dynamic balance is the equal distribution of weight on each side of the wheel so that when the wheel spins there is no tendency for the assembly to move from side to side. Wheels that are dynamically unbalanced may cause shimmy, Fig. 10-6.

4. Recommended Balance Method

Off the car static and dynamic balance is recommended to maximize balance accuracy. Rotation of tires without rebalance can be performed with this method without balance degradation. However, due to component static balance stack up (brake drums, front hub and rotor, rear axles, etc.) ON CAR "STATIC" balance will produce an additional ride smoothness improvement after off car balancing.

5. Factory Balance Method and Specification

Cadillac "C" and "D" tire/wheel assemblies are statically balanced to a tolerance of 0.5 ounce at the rim. Correction weight is added to the inside rim up to 3.0 ounces and the remainder up to a total of 5.0 ounces to the outer rim.

Cadillac "E" tire/wheel assemblies are two-plane dynamically balanced to a tolerance of 0.5 ounce per rim. The factory balancing method does not place the dynamic weights equal and opposite as illustrated in the shop manual diagram. Therefore, if a balance problem is suspected it is necessary to check the factory balance accuracy on your shop equipment. The balance should also be accurate to a static balance tolerance of 0.5 ounce at the rim. Static correction weight should be split between the inner and outer rim flange to preserve the dynamic balance if required.

(NOTE: The factory uses precision equipment and considerable manpower to achieve balance specifications. Before removing factory weight, check balance accuracy, if necessary.)

6. Off-Car Balancing

When an off-car spin balance is performed, it is best

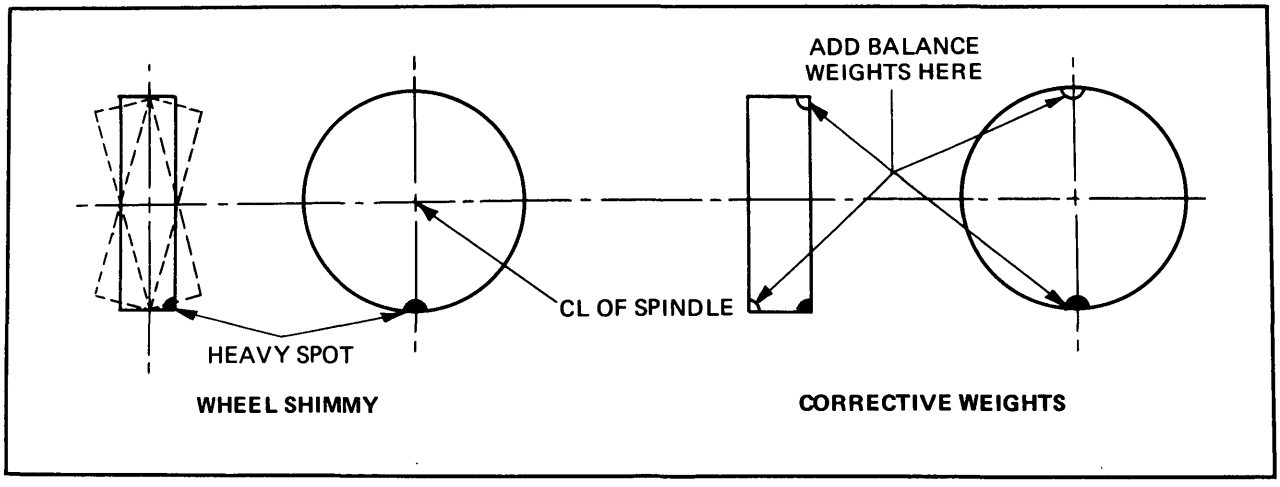


Fig. 10-6 Dynamic Unbalance Correction (Weight Placement Illustrated for Bead Equipment Correction Method)

BACK TO INDEX

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that equipment be used that pilots on the center hole, not the lug holes.

- General Balance Precautions

Deposits of mud, etc. must be cleaned from the inside of the rim. Stones should be pried from the tread in order to avoid operator injury during spin balancing and to obtain a good balance. The tire should be inspected for any damage, then balanced according to the equipment manufacturer's recommendation.

7. On-Car Balancing

a. Rear Wheels

To distinguish between standard and controlled axles on passenger cars, raise rear of vehicle so both wheels are clear of ground. With transmission in park, attempt to turn one wheel. If you can turn a wheel, it is a standard axle. If you cannot turn a wheel, it is a controlled differential.

- Standard Axle

On Vehicles equipped with standard axle, raise rear of vehicle with floor jack under differential. This must be done to allow car to vibrate while balancing. Place a block under the opposing wheel and let vehicle down so opposing wheel sits on block and the wheel to be balanced is at least two inches off the ground, Fig. 10-7. This is to allow only one wheel to spin. Proceed with balance, using engine power to spin the wheel. Use a spinner to drive rear wheels on front wheel drive cars.

WARNING: ON CARS THAT DO NOT HAVE A CONTROLLED DIFFERENTIAL, DRIVE WHEEL SPIN SHOULD BE LIMITED TO 35 MPH AS INDICATED ON THE SPEEDOMETER. THIS LIMIT IS NECESSARY BECAUSE THE SPEEDOMETER ONLY INDICATES ONE-HALF OF THE ACTUAL WHEEL SPEED WHEN ONE DRIVE WHEEL IS SPINNING AND THE OTHER DRIVE WHEEL IS STOPPED. UNLESS CARE IS TAKEN IN LIMITING DRIVE WHEEL SPIN, THE SPINNING WHEEL CAN REACH EXCESSIVE SPEEDS. THIS CAN RESULT IN POSSIBLE TIRE DISINTEGRATION OR DIFFERENTIAL FAILURE, WHICH COULD CAUSE SERIOUS PERSONAL INJURY OR VEHICLE DAMAGE.

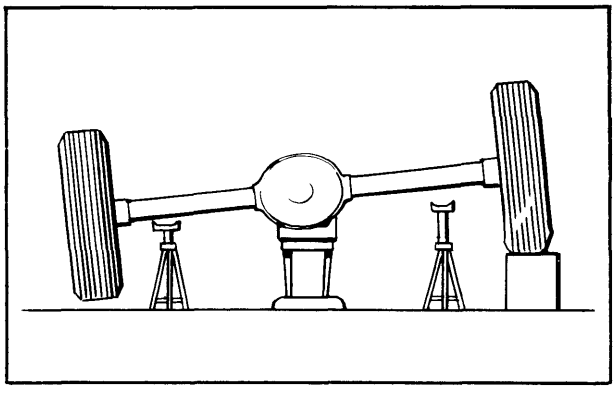


Fig. 10-7 Standard Axle

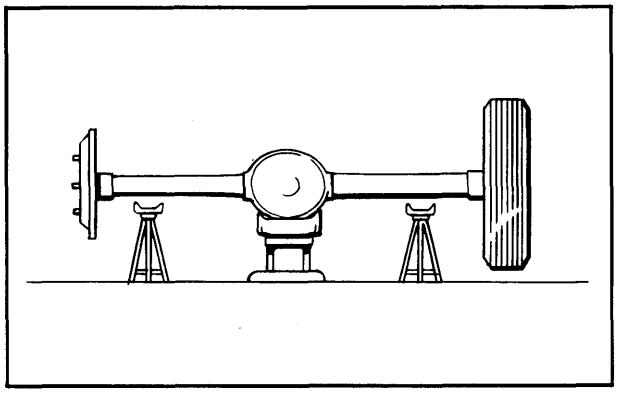


Fig. 10-8 Controlled Axle

- Controlled Axle

On vehicles equipped with a controlled differential, the following procedure should be used:

Raise rear of vehicle with floor jack under differential. Put jack stands under axle as safety measure, but do not put car weight on stands. Remove one wheel, Fig. 10-8. Install two lug nuts on opposing studs to retain the brake drum. Balance the remaining wheel using engine power to spin the wheel. When proper balance has been achieved on first wheel, re-install the second wheel and balance.

WARNING: ON CARS THAT HAVE A CONTROLLED DIFFERENTIAL:

- **DRIVE WHEEL SPIN SHOULD BE LIMITED TO 70 MPH. THIS IS TO PREVENT TIRE DISINTEGRATION WHICH COULD RESULT IN SERIOUS PERSONAL INJURY AND PROPERTY DAMAGE.**
- **DO NOT ATTEMPT TO BALANCE A TIRE ON A DRIVE WHEEL WITH THE OTHER DRIVE WHEEL ON THE GROUND. THE CAR MAY DRIVE THROUGH THIS WHEEL AND CAUSE THE VEHICLE TO MOVE UNEXPECTEDLY, RESULTING IN PERSONAL INJURY AND PROPERTY DAMAGE.**

b. Front Wheels

Front of vehicle should be lifted with floor jack under front cross member in center of frame.

8. Eldorado Front Wheel Balance

"On car" balancing of Eldorado front wheel and tire assemblies require heavy duty equipment.

Suspension arm hook J-24842-01 must be installed on the Eldorado front suspension before balancing is attempted to keep suspension at normal standing height to avoid excitements from angulated joints in drive axles.

Fig. 10-9 shows the hook in the installed, on car position. The installation and removal procedures are as follows:

BACK TO INDEX

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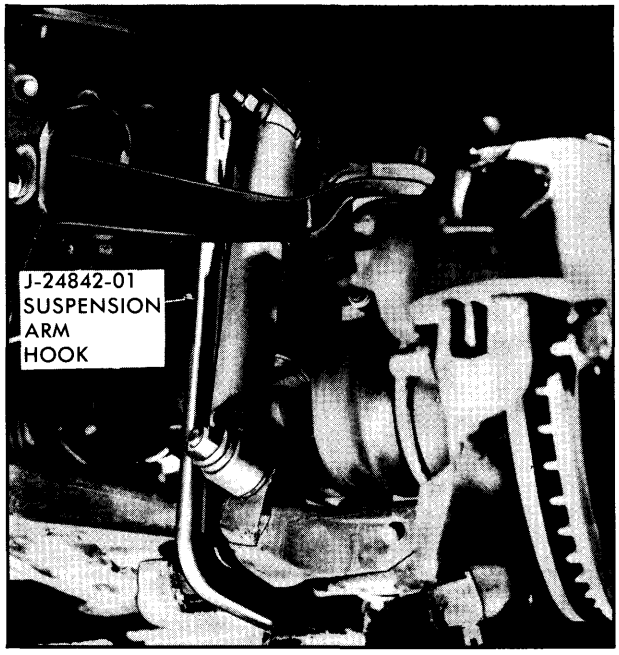


Fig. 10-9 Suspension Arm Hook

a. Installation

1. Open hood.
2. Reaching over fender position hook through upper control arm inboard of front shock absorber, engaging lower end of hook into channel in lower control arm (as shown) below shock absorber lower mount.
3. Using your body weight on fender, engage top of hook in hole in top of upper shock absorber mount.

b. Removal

1. Using your body on fender, disengage top of hook from upper shock absorber mounting bracket hole.
2. Working hook downward, disengage hook at lower control arm and remove hook.
3. Close hood.

DIAGNOSIS

9. Irregular and/or Premature Tire Wear

Irregular and premature tire wear has many causes. Some of them are: incorrect inflation pressures, lack of tire rotation, driving habits, improper wheel alignment.

a. Rotate tires if the following conditions exist:

- Front tire wear is different from rear.
- Uneven wear exists across the tread of any tire.
- Left front and right front tire wear is unequal.
- Left rear and right rear tire wear is unequal.
- There is cupping, flat spotting, etc.

b. A wheel alignment check is in order if the following conditions are noted:

- Left front and right front tire wear is unequal.
- Rapid wear on one edge of any front tire.
- Front tire treads have scuffed appearance with "feather" edges on one side of tread ribs or blocks.

10. Tire Wear Indicators

Tires have built-in tread wear indicators to show when they need replacing. These indicators will appear as 1/2 inch wide bands when the tire tread depth becomes 1/16 of an inch. When the indicators appear in two or more adjacent grooves at three locations around the tire or when cord or fabric is exposed, tire replacement due to tread wear is recommended, Fig. 10-10.

11. Vibration

Wheel unbalance causes about 75% of the highway speed vibration problems, so balance should be checked first. However, if a vibration remains after careful on-car balancing, it can be caused by three things, Fig. 10-11:

1. Tire runout.
2. Wheel runout.
3. Tire stiffness variation.

Measuring tire and/or wheel runout will uncover only part of the problem. It's best to check all three causes at the same time. This can be done by using a Tire Problem Detector (TPD) as in the following diagnosis charts.

LOADED RADIAL RUNOUT

The loaded radial runout, from any source (Fig. 10-11) causes spindle movement. As the vehicle speed increases, this speed movement speeds up. At highway speed, it matches the resonant frequency of most cars' suspension systems and causes a shake-type ride or car vibration. Tire stiffness is the result of the building variables and called "radial force variation". This quality parameter is controlled by the tire suppliers and corrected if necessary by tread shoulder buffing. All Cadillac Eldorado tire and wheel assemblies are also monitored and corrected at the factory.

BACK TO INDEX

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BACK TO INDEX

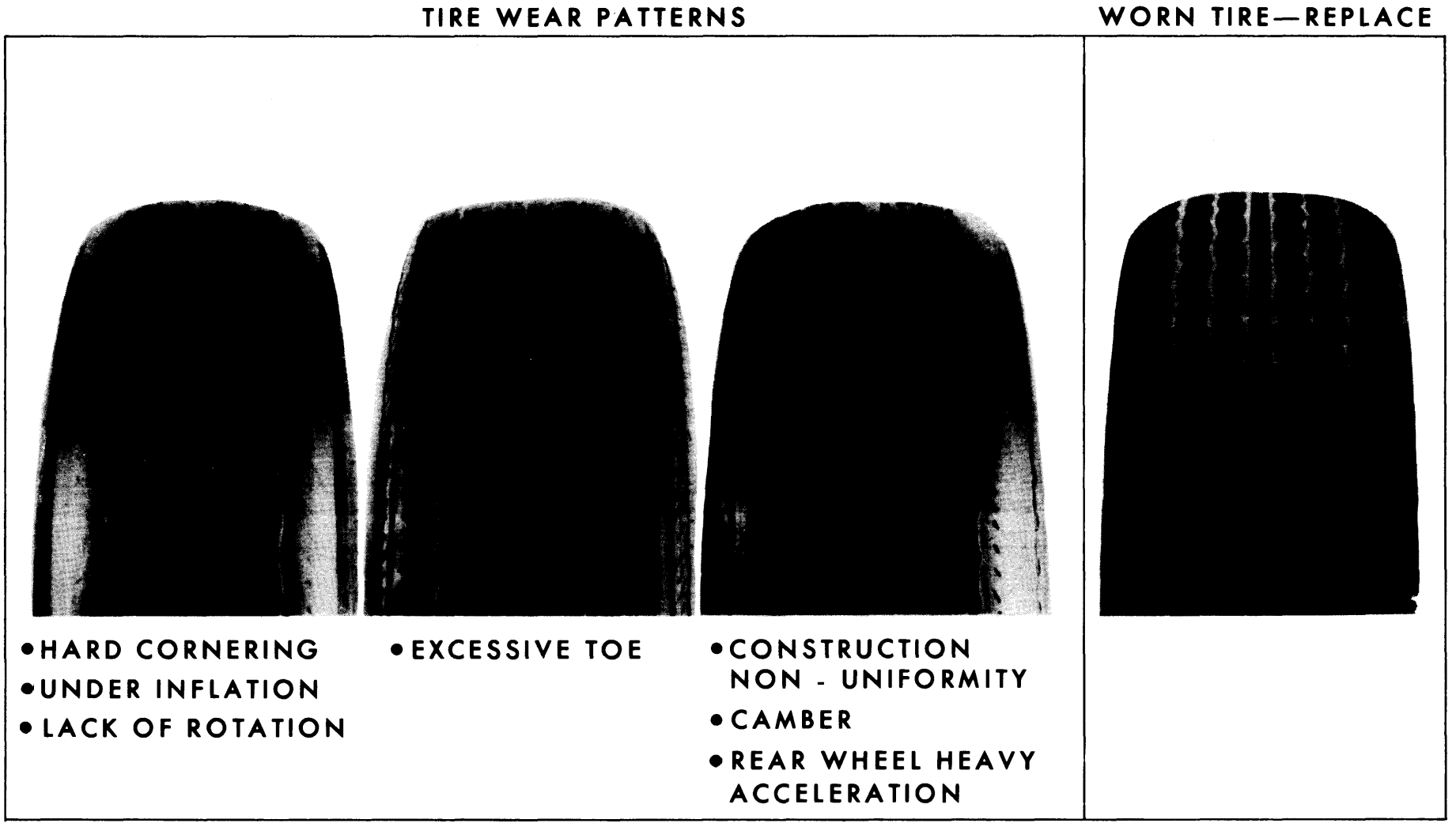


Fig. 10-10 Tread Wear Indicators

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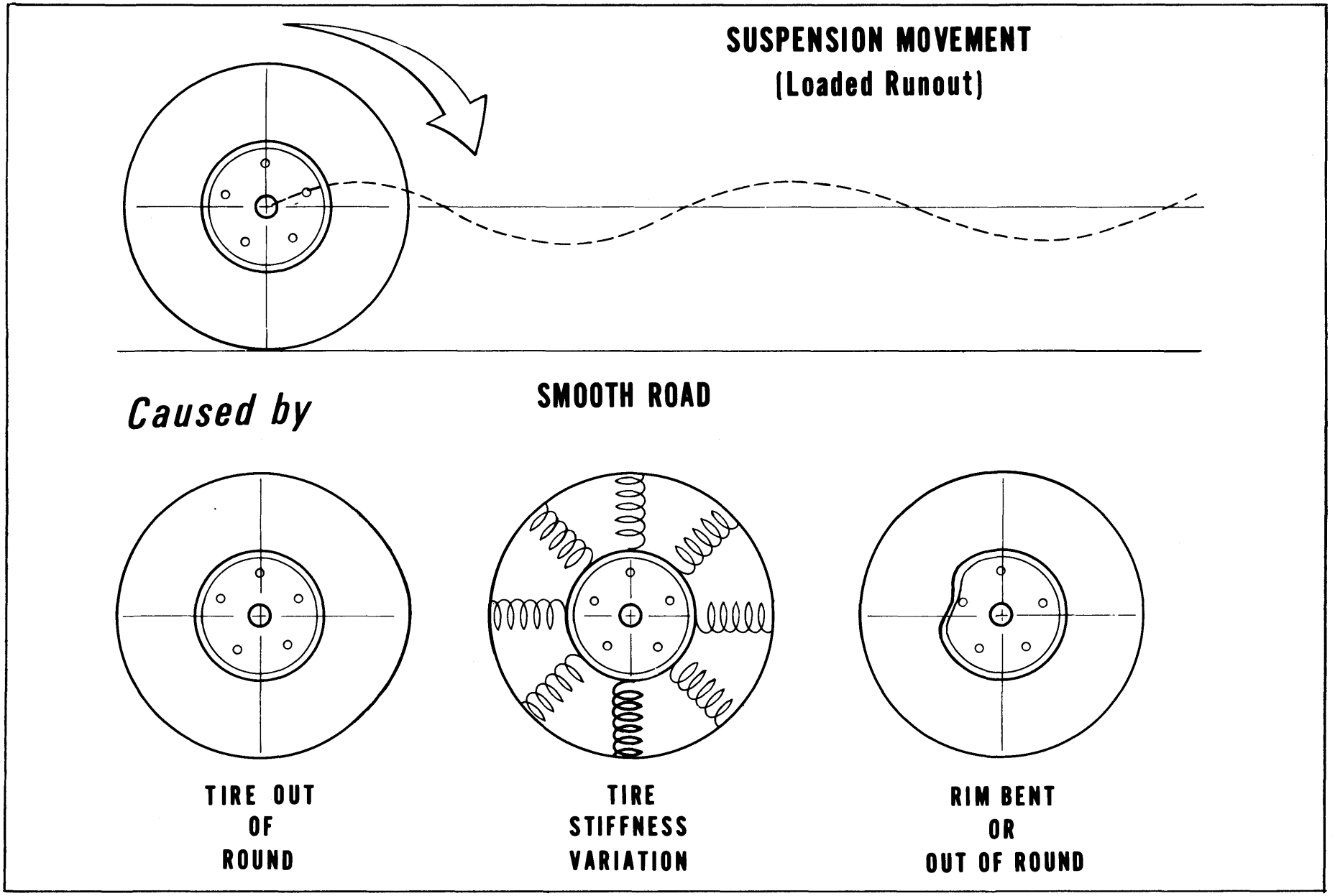


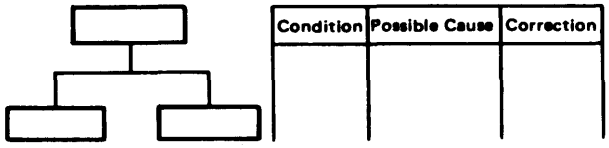
Fig. 10-11 Causes of Vibration

BACK TO INDEX
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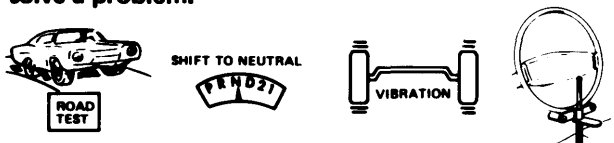
DIAGNOSIS CHARTS

Introduction

This section presents a systematic method of diagnosing and troubleshooting RADIAL–LATERAL VIBRATION. The charts you will be using are different from the ones you have used before. They aren't "go–no go" decision trees or tables.



Instead the new diagnosis and troubleshooting charts use pictures plus a few words to help you solve a problem.

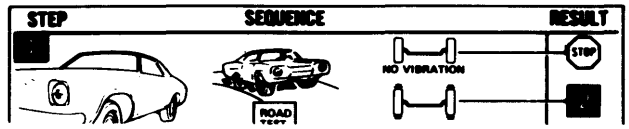


and symbols have replaced words.

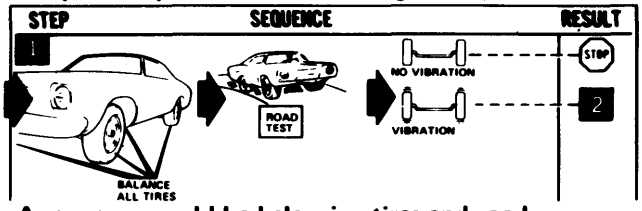


Using the Charts

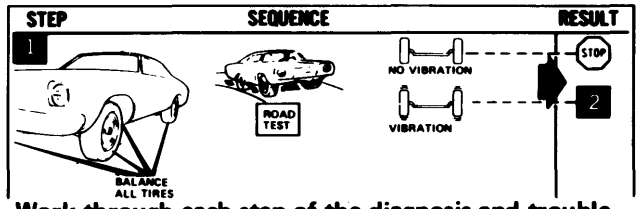
The charts are divided into three sections: step, sequence and result.



Always start at the first step and go through the complete sequence from left to right.

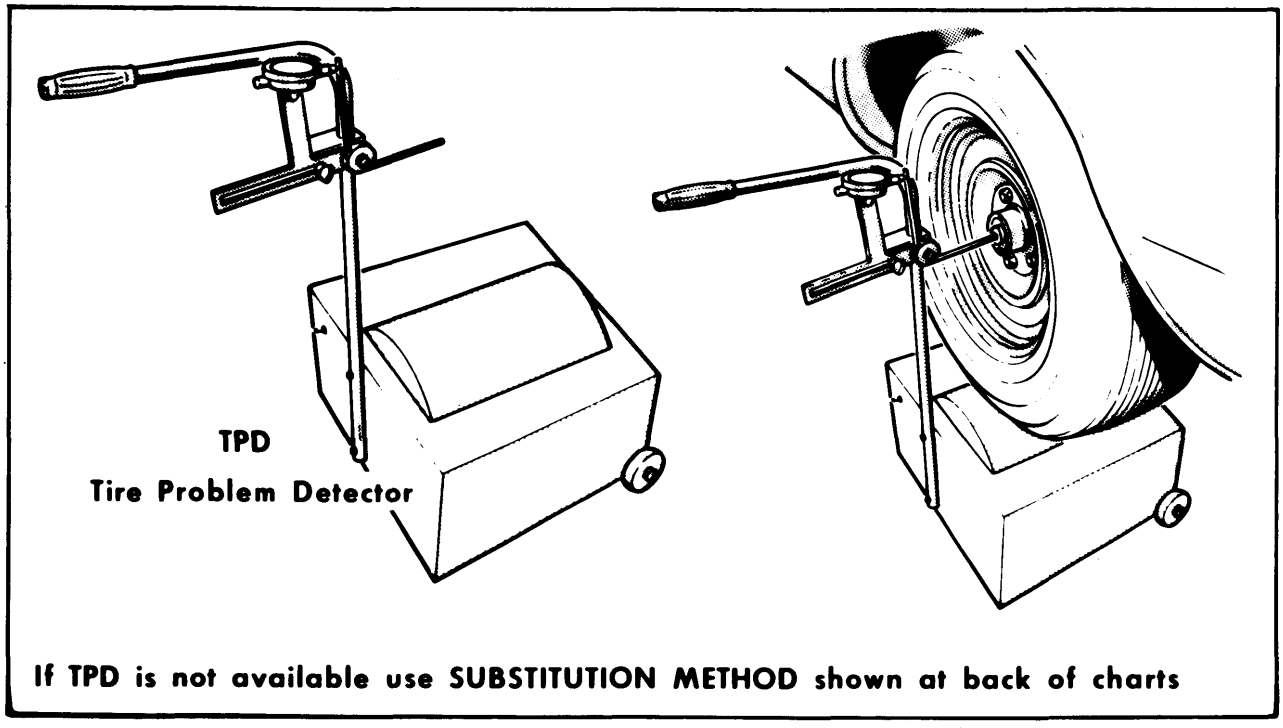


A sequence could be balancing tires and road testing for vibration. Each sequence ends with a result and tells you the next step to go to.



Work through each step of the diagnosis and trouble-shooting charts till the system is repaired. STOP

Using the TPD for RADIAL-LATERAL VIBRATION



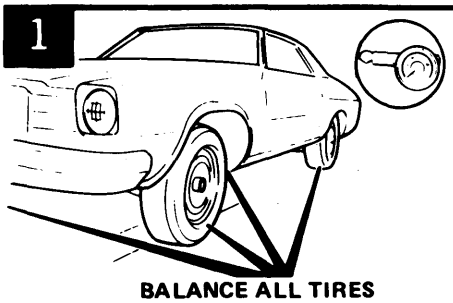
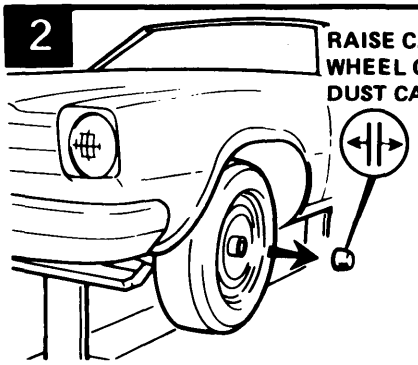
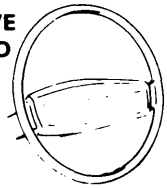
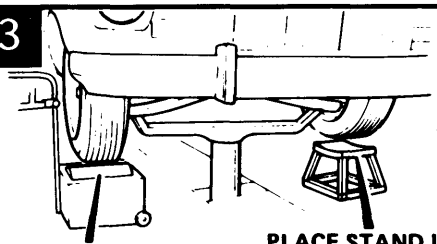
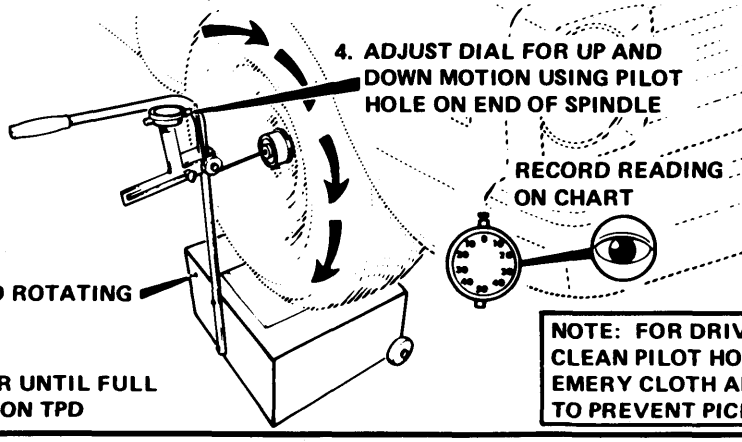
If TPD is not available use SUBSTITUTION METHOD shown at back of charts

BACK TO INDEX

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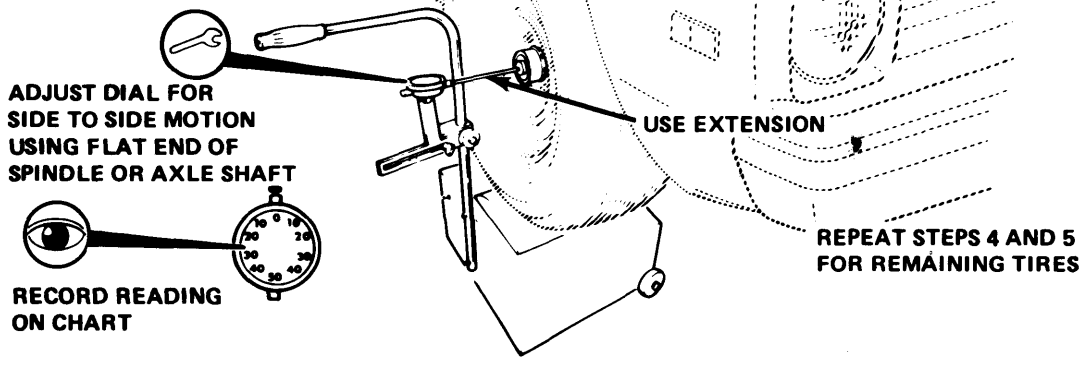
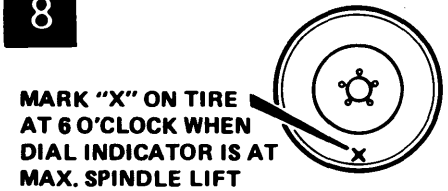
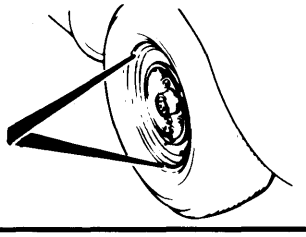
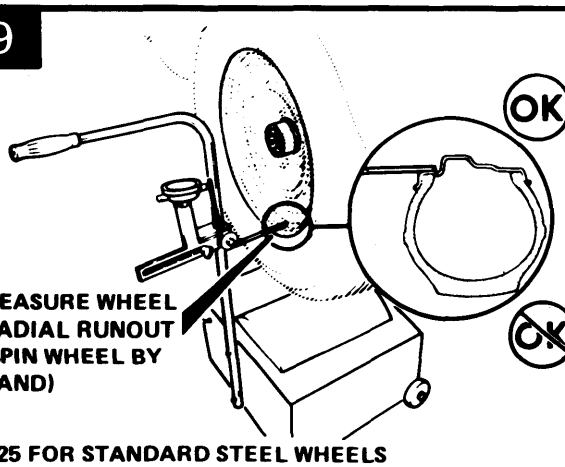
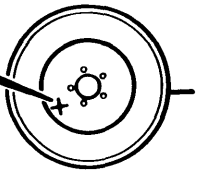
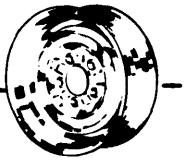
Vibration only . . . . . Start with 1

Waddle, or Vibration and Waddle . . . Start with 2

STEP	SEQUENCE	RESULT
1	 BALANCE ALL TIRES ADJUST TIRES TO RECOMMENDED PRESSURE  ROAD TEST (BALANCE WILL NOT AFFECT WADDLE)  NO VIBRATION  VIBRATION	STOP 2
2	 RAISE CAR - REMOVE WHEEL COVERS AND DUST CAPS  FOR FRONT WHEELS: USE IGNITION LOCK. WHEELS IN STRAIGHT-AHEAD POSITION. FOR FRONT WHEEL DRIVE SHIFT TO NEUTRAL AND BRACE STEERING WHEEL FOR CHECKING DRIVE WHEELS, SHIFT TO NEUTRAL 	3
3	 CENTER TPD UNDER TIRE PLACE STAND UNDER OPPOSITE TIRE SAME HEIGHT AS TPD ON CARS WITH LIMITED SLIP DIFFERENTIAL, MOVE DRIVE TIRES TO FRONT OF THE CAR FOR TESTING NOTE – TIRES MUST ROTATE: RIGHT SIDE - CLOCKWISE LEFT SIDE - COUNTER CLOCKWISE	4
4	RADIAL UP AND DOWN 1. MAKE CHART LF RF LR RR RADIAL (UP AND DOWN)  2. START TPD ROTATING 3. LOWER CAR UNTIL FULL WEIGHT IS ON TPD 4. ADJUST DIAL FOR UP AND DOWN MOTION USING PILOT HOLE ON END OF SPINDLE RECORD READING ON CHART REPEAT FOR OTHER THREE TIRES NOTE: FOR DRIVE AXLE, CLEAN PILOT HOLE WITH EMERY CLOTH AND LUBRICATE TO PREVENT PICKUP CHATTER	5

BACK TO INDEX

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STEP	SEQUENCE	RESULT
5	LATERAL SIDE ← TO → SIDE  ADJUST DIAL FOR SIDE TO SIDE MOTION USING FLAT END OF SPINDLE OR AXLE SHAFT USE EXTENSION RECORD READING ON CHART REPEAT STEPS 4 AND 5 FOR REMAINING TIRES LATERAL (SIDE TO SIDE) — LF RF LR RR	7
6	 RECHECK NEW ASSEMBLY PER STEPS 4 AND 5 REVISE TABLE RADIAL (UP AND DOWN) — LF RF LR RR LATERAL (SIDE TO SIDE) — LF RF LR RR	7
7	 IF ALL RADIAL READINGS ARE LESS THAN .035 IF ANY RADIAL READING IS MORE THAN .035	13 8
8	 MARK "X" ON TIRE AT 6 O'CLOCK WHEN DIAL INDICATOR IS AT MAX. SPINDLE LIFT RAISE CAR OFF ROLLER CLEAN WHEEL SURFACE 	9
9	 MEASURE WHEEL RADIAL RUNOUT (SPIN WHEEL BY HAND) .025 FOR STANDARD STEEL WHEELS .035 FOR OTHER OK — MARK "X" ON WHEEL WHERE IT RUNS OUT LEAST  OK — REPLACE WHEEL REBALANCE 	10 6

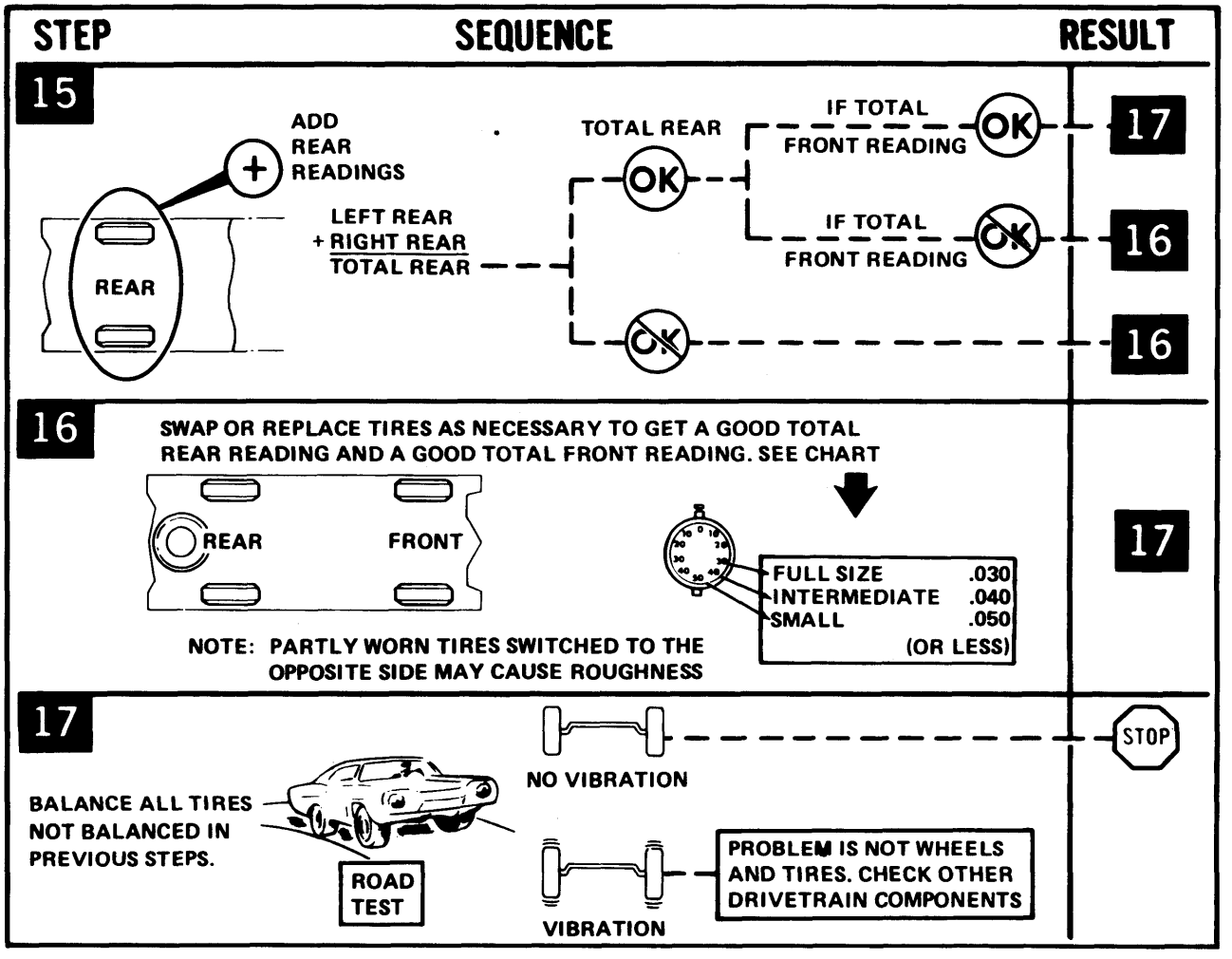
BACK TO INDEX

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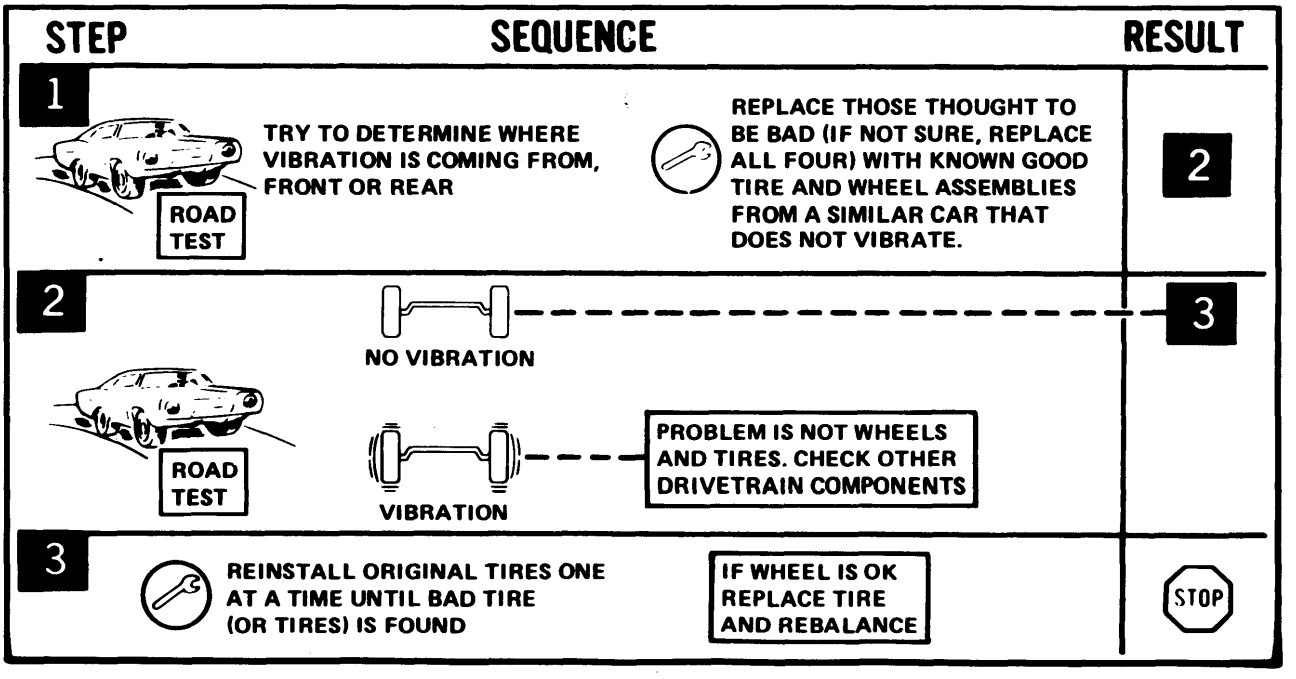
STEP	SEQUENCE	RESULT
10	SUBTRACT THE WHEEL RUNOUT READING IN STEP 9 FROM THE RADIAL READING IN STEP 4 RADIAL READING – WHEEL RUNOUT MORE THAN .035 LESS THAN .035	11 12
11	REPLACE TIRE REBALANCE	6
12	"X's" MORE THAN 90° APART REMOUNT TIRES WITH "X's" TOGETHER REBALANCE RECHECK PER STEP 4 MORE THAN .035 LESS THAN .035 "X's" LESS THAN 90° APART	11 7 11
13	IF LATERAL READING FROM STEP 5 IS MORE THAN .030 FOR ANY SINGLE TIRE REPLACE TIRE IF LATERAL READING FROM STEP 5 IS LESS THAN .030 FOR EACH TIRE	6 14
14	DETERMINE IF CAR IS MAXIMUM ACCEPTABLE TOTAL LATERAL SPINDLE MOVEMENT FULL SIZE ..... .030 INTERMEDIATE ..... .040 SMALL ..... .050 ADD FRONT READINGS FRONT LEFT FRONT + RIGHT FRONT TOTAL FRONT	15

BACK TO INDEX

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SUBSTITUTION METHOD



BACK TO INDEX

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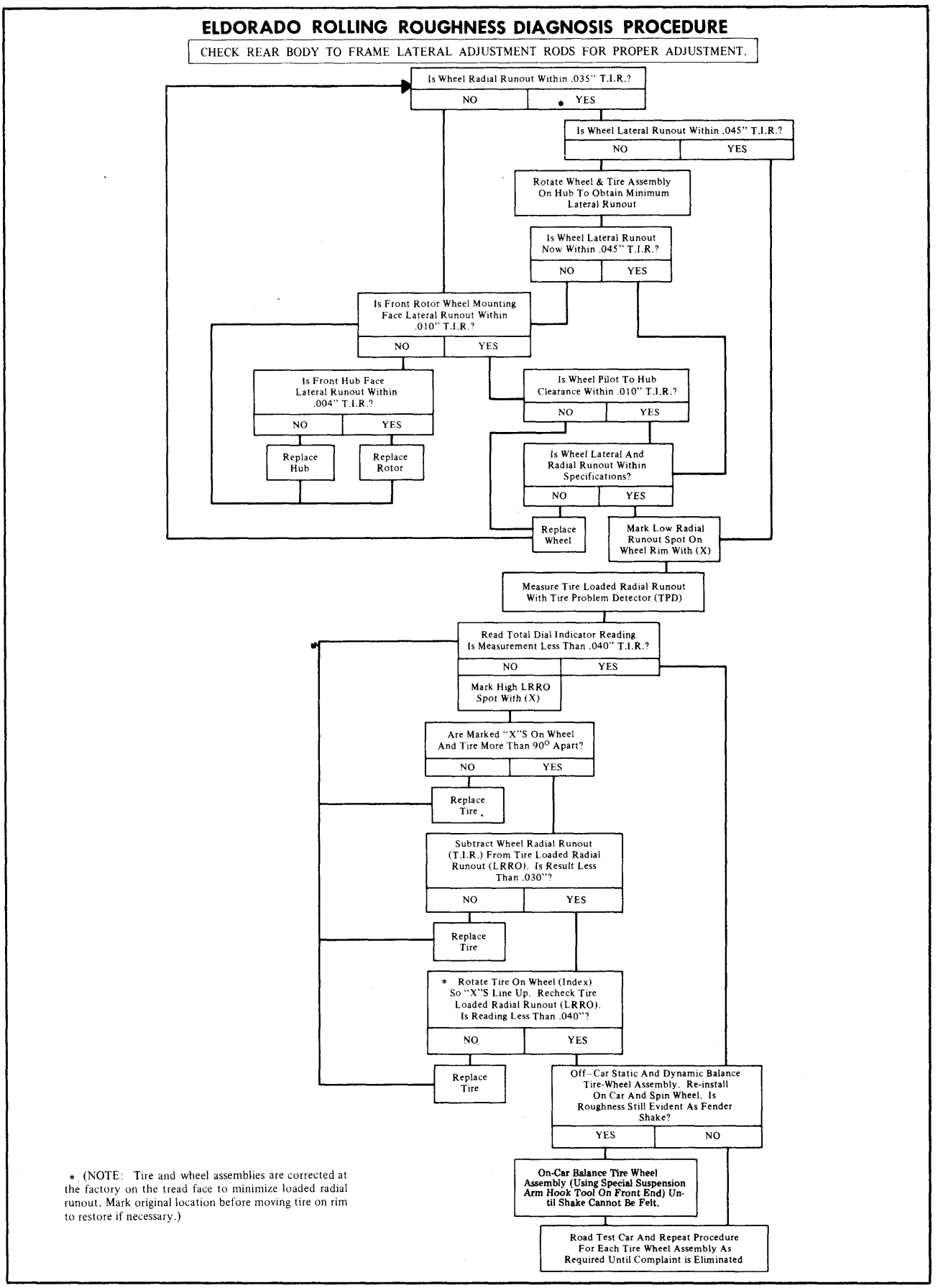


Fig. 10-12 Diagnosis Procedure

BACK TO INDEX

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SUBSTITUTION METHOD

If a TPD is not available the more time consuming method of substituting known good tire and wheel assemblies on the problem vehicle can be used as follows:

1. Ride vehicle and attempt to determine if the vibration is coming from the front or rear.
2. Install tires and wheels that are known to be good (on similar vehicles) in place of those on the offending end of the problem vehicle. If vibration cannot be isolated to front or rear, substitute all car tire and wheel assemblies.
3. If there is no improvement, then either the "good" set is not good, or the vibration is caused by something other than tires and wheels.
4. Replace original tires one at a time until offender is found.

12. Correcting Non-Uniform Tires

If a replacement tire cannot be obtained, there are several methods commonly used to correct tires which cause a vibration even though they are properly balanced. The best method uses an automatic machine which buffs small amounts of rubber from selected spots on the outer two tread rows. Correction by this method is usually permanent, and, if done properly, does not significantly affect the appearance or tire tread life. Tire truing with a blade-type machine is not recommended as this reduces the tread life substantially and often does not permanently correct the problem.

Another method which quite often works is to dismount the tire and rotate it 180 degrees on the rim. It is important that this only be done on tire assemblies which are known to be causing a vibration as it is just as likely to make good assemblies worse.

13. Lateral Force Variation (Radial Tire Waddle) Complaint Description

Waddle is side to side movement at the front and/or rear of the car. Fig. 10-13. It is caused by lateral force variation in one or more of the radial tires. It is most noticeable at low speed, 5 to 30 MPH. It may also appear as a ride roughness at 50 to 70 MPH.

It is possible to road test a car and tell on which end of the car the objectionable tire is located. If the waddle tire is on the rear, the rear end of the car will shake from side to side or "waddle". From the driver's seat it feels as though someone is pushing on the side of the car.

If the objectionable tire is on the front, the waddle is more visual. The front sheet metal appears to be moving from side to side and the driver feels as though he is at the pivot point in the car.

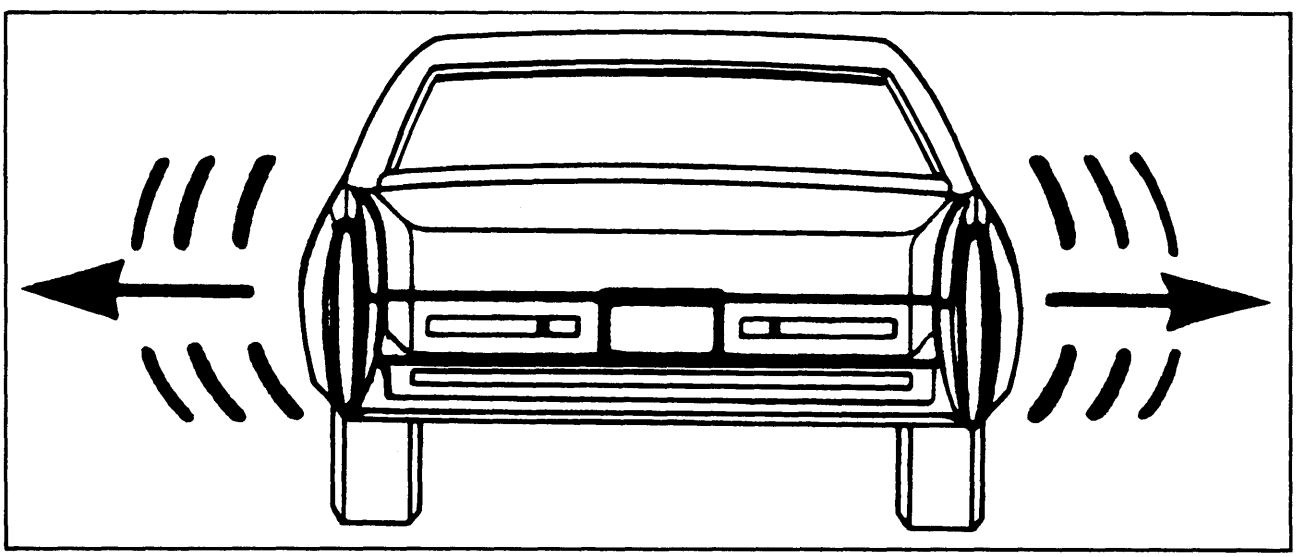


Fig. 10-13 Radial Tire Waddle

It should be noted that if the waddle condition is constant within a certain speed range, it is probably caused by one tire. If, however, the waddle condition comes and goes within this speed range, it is probably caused by two tires, on the same end of the car, going into and out of phase with each other.

BACK TO INDEX

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VEHICLE DIRECTIONAL LEAD

"Lead", is the deviation of the vehicle from a straight path on a level road with no corrective force on the steering wheel.

Lead is usually caused by these conditions: 1) alignment, 2) uneven brake adjustment, 3) tire construction and 4) uneven tire pressure. This section relates how to tell between tire lead and the need for alignment correction.

The way in which a tire is built can produce lead in a vehicle. An example of this is placement of the belt. Off center belts on radial tires can cause the tire to develop a side force (conicity) while rolling straight down the road. If one side of the tire is a little larger diameter than the other, the tire will tend to roll to one side. This develops a side force that can produce vehicle lead.

The procedure in Fig. 10-14 should be used to insure that front alignment is not mistaken for tire lead.

- Part of the lead diagnosis procedure is different from the proper tire rotation pattern currently in the Owners Manual. The Owners Manual recommends front to rear rotation only. If a medium to high mileage tire is moved to the other side of the car, be sure to check that rolling smoothness has been maintained.
- Rear tires will not cause lead. However, high conicity forces at the rear wheel positions can cause "dog-tracking."

BACK TO INDEX

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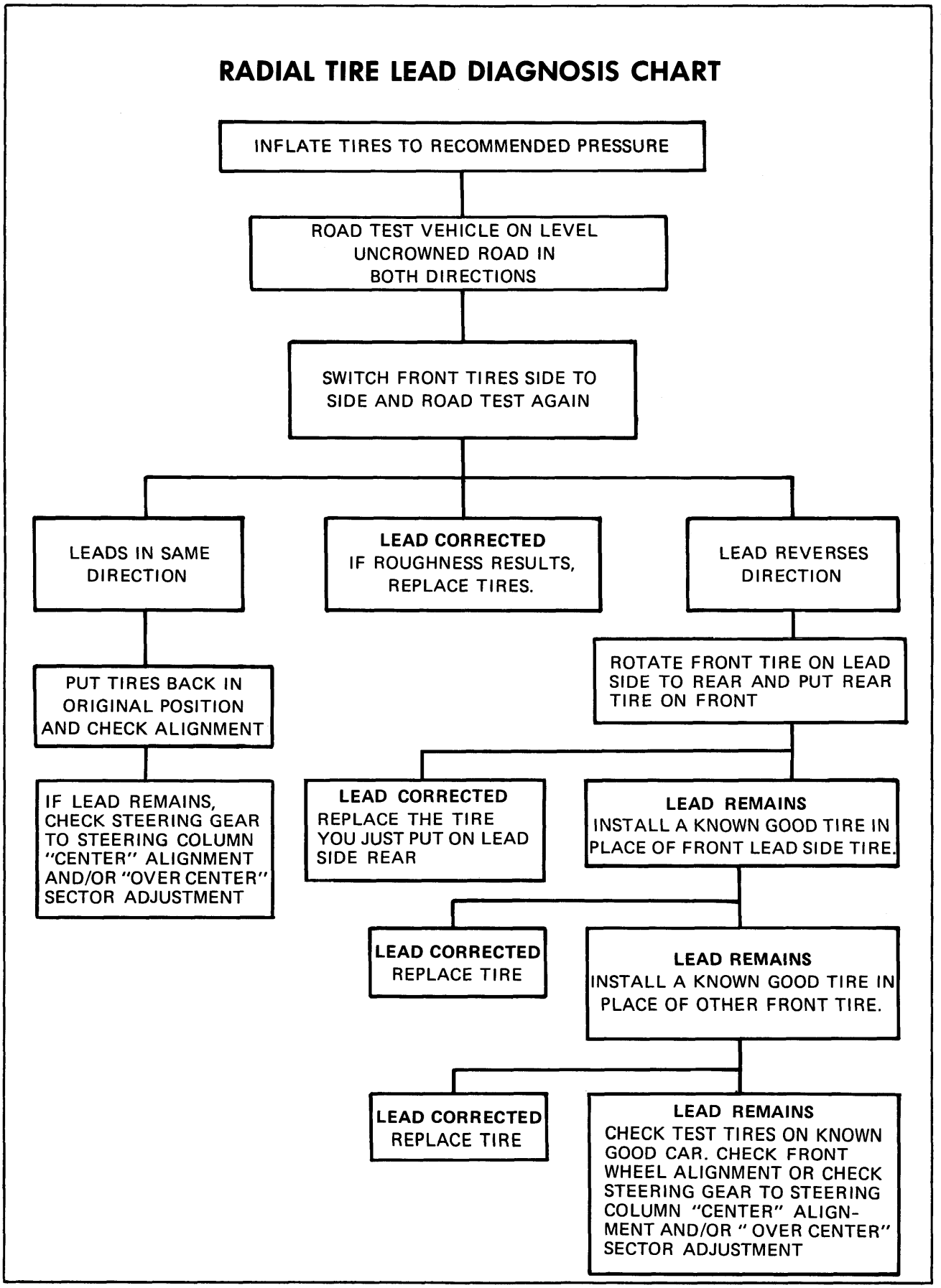


Fig. 10-14 Lead Diagnosis Chart

BACK TO INDEX

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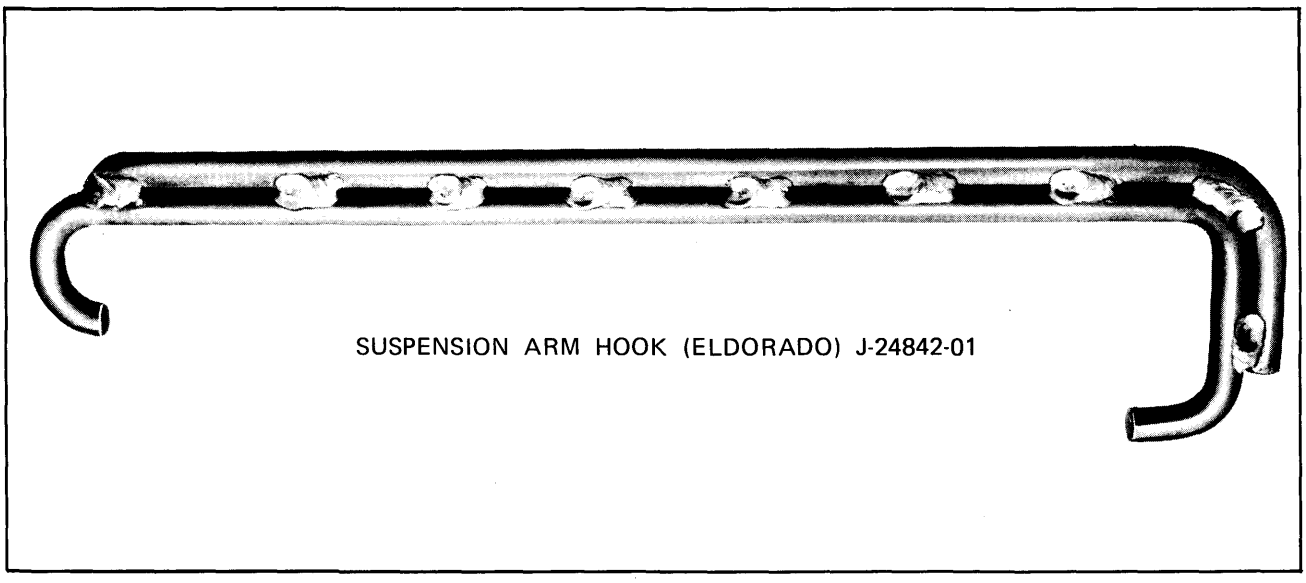


Fig. 10-15 Special Tools

BACK TO INDEX

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WARNING: IF EQUIPPED WITH AIR CUSHION RESTRAINT SYSTEM, DO NOT ATTEMPT ANY ADJUSTMENT, REPAIR OR REMOVAL OF ANY PORTION OF THE CHASSIS SHEET METAL WHICH WOULD REQUIRE REMOVAL OR DISCONNECTING OF THE BUMPER IMPULSE DETECTOR UNTIL THE DISCONNECTION PROCEDURE IS COMPLETED. THIS PROCEDURE MUST BE FOLLOWED TO PREVENT ACCIDENTAL DEPLOYMENT OF THE SYSTEM WHICH COULD RESULT IN PERSONAL INJURY AND/OR DAMAGE TO THE SYSTEM'S COMPONENTS. IN ADDITION, CARE MUST BE EXERCISED TO NEVER BUMP OR STRIKE THE BUMPER IMPULSE DETECTOR IN A MANNER WHICH COULD CAUSE INADVERTENT DEPLOYMENT OR IMPROPER OPERATION OF THE SYSTEM.

A.C.R.S. DISCONNECTION PROCEDURE

1. Turn ignition switch to "LOCK" position. Disconnect the negative battery cable from the battery and tape end.

GENERAL DESCRIPTION

The chassis sheet metal described in this section consists of the following items: hood, front fenders, and wheelhousings.

The hood is hinged near the cowl and opens from the front. The hood primary lock is located in the center of the hood lock tie bar on the radiator cradle.

The hood is unlocked by pulling on the hood lock release handle that is located on the left kick panel just below the headlight switch, Fig. 11-1. The hood secondary latch release lever, Fig. 11-2, is accessible between the grille and hood panel after the primary lock has been actuated. Upward pressure on the hood latch secondary lever, Fig. 11-2, permits the hood to be raised.

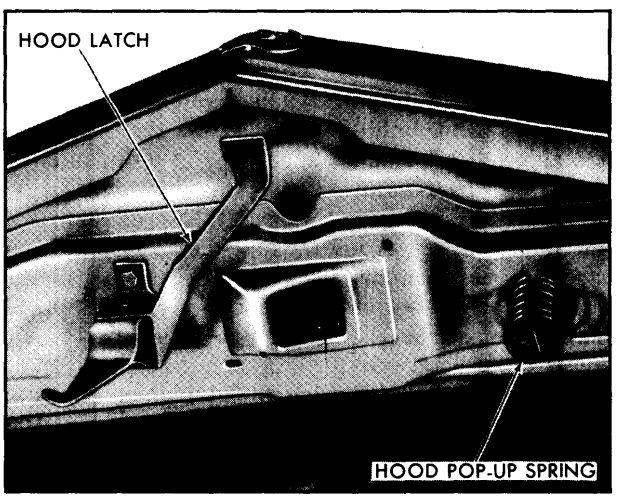


Fig. 11-2 Hood Release Lever



Fig. 11-1 Hood Lock Release Handle

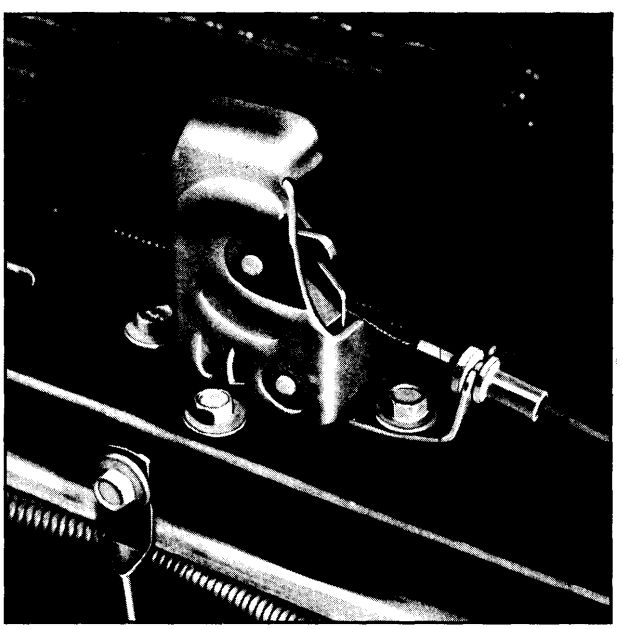


Fig. 11-3 Hood Primary Lock

BACK TO INDEX

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SERVICE INFORMATION

1. Hood Latch Mechanism Adjustment

The hood latch assembly consists of a hood primary lock, Fig. 11-3, attached to the radiator cradle tie bar in the center by three screws and a hood secondary latch release lever attached to the hood inner panel by two screws. Tighten primary latch screws and secondary latch screws to 18 foot-pounds.

CAUTION: These hood latch assembly fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with equivalent parts if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

The striker plate in the hood panel is large enough to take care of any fore and aft adjustment necessary. Cross car adjustment only is provided at the hood lock mounting. Up and down adjustment is provided in the lock itself which has an automatic take up latch.

When the hood latch assembly has been removed, the mounting screws loosened, or the hood adjustment changed, make certain that proper alignment has been obtained before tightening the mounting screws. Proper adjustment of the primary lock is achieved by slowly lowering the hood onto the lock with the three attaching screws loose. Raise the hood and tighten screws to proper torque. Failure to do so may result in damage to the latching assembly and/or excessive release handle efforts due to misalignment when the hood is closed.

The following procedure is recommended for checking hood latch adjustments:

a. Drop hood from a height of 6 to 8 inches above closed position. The latch must engage.

b. The latch must release when release handle is pulled without lifting the hood.

Hood latches that do not engage or release properly must be corrected by proper adjustment of the hood latch and the hood adjustable bumpers. These adjustments are also used to bring the hood flush with the fenders.

c. Lower hood slowly until the striker plate rests on the latch. With hood in this position, secondary latch must be engaged under hood latch tie bar on radiator cradle. A vertical pull up at one of the forward corners of the hood and the center will indicate that proper secondary installation has been performed, in that the hood will be restricted from opening beyond the hook of the secondary latch.

d. Both primary and secondary latches must be free of excess friction or binding when operated.

2. Hood Panel

a. Removal (Fig. 11-4)

1. Scribe hinge locations on underside of hood panel to aid in repositioning the hood when it is reinstalled.

2. Remove six screws and washers, three each side, retaining hinge assemblies to hood panel.

3. Remove hood with the aid of a helper, using care to avoid damaging finish.

CAUTION: When hood is removed from car, never stand it upright on rear corners nose up. Hood must be positioned so that it rests on its side; otherwise, damage to sheet metal may result.

b. Installation (Fig. 11-4)

(NOTE: Install an exhaust manifold stud in center holes of hood retaining plate to help locate and position adjusting screws when installing hood.)

1. With the aid of a helper, place hood in position on hood hinge assemblies and loosely install three screws and washers at each hinge assembly.

2. Position hood so that hinges line up with scribe marks and tighten screws at each hinge to 30 foot-pounds.

3. Carefully close hood and check alignment of hood at fender and grille opening.

4. Align hood, if necessary, as described in Note 3.

5. Adjust hood latch mechanism as described in Note 1.

3. Hood Adjustment

1. Loosen hood attaching screws, three at each hood hinge, fig. 11-4. Elongated holes in hinge provide fore, aft, and side adjustment of hood. Position hood so that tolerances shown in Fig. 11-8 (Fig. 11-9 on Eldorados) are provided.

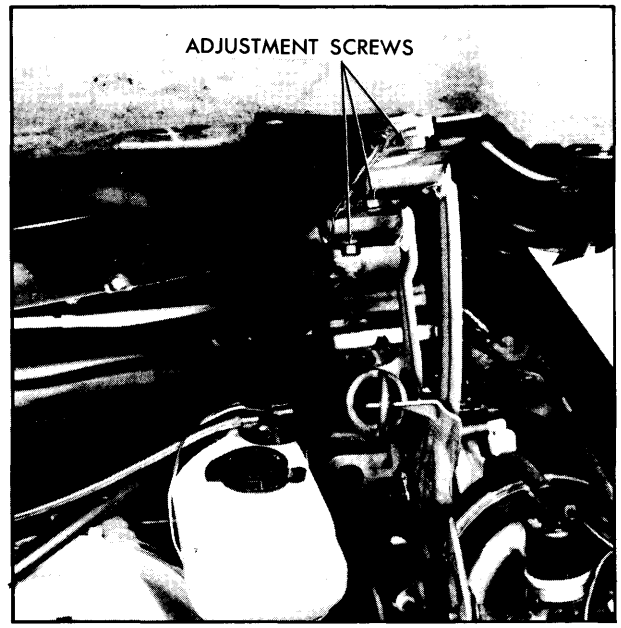


Fig. 11-4 Hood Hinge

BACK TO INDEX

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2. Tighten hinge to hood attaching screws on both sides to 30 foot-pounds.
3. Adjust rubber bumpers, located on the tie bar, one each side, so that hood panel is flush with fenders at this point.
4. Adjust hood latch mechanism as described in Note 1.

4. Hood Hinge Spring

a. Removal (Fig. 11-4)

1. Open Hood and prop as high as possible.
2. Using a strong wire hook, attach one end to center of pry bar of sufficient length and the other end to hinge spring.
3. With the aid of a helper, lift pry bar until spring disengages from hood hinge, then release pressure on bar slowly until spring is loose, then unhook other end of spring from hinge.

b. Installation (Fig. 11-4)

1. Hook one end of spring on hinge, then with the aid of a helper, use pry bar and wire hook to connect spring to front of hinge.
2. Remove prop and close hood.

5. Front Fender (Right or Left) Except Eldorado

a. Removal (Fig. 11-5)

1. If left fender is to be removed, disconnect negative battery cable, and remove coolant reservoir. If right front fender is to be removed, remove the battery and the power antenna (Section 12, Note 51).

Note number of shims at each attaching location so that the same number are installed during installation.

2. Remove 4 bolts holding hood hinges to fenders, and remove hood.
3. Apply masking tape to rear edge of fender to avoid scratching finish when removing fender.
4. Raise front end of car and remove wheel on side of car from which fender is being removed.
5. Remove rocker panel molding.
6. Remove one screw and shims retaining fender to door at lower hinge pillar.
7. Remove one screw and shims that hold rear bottom of fender to rocker panel.
8. Remove five fender attaching screws from wheel opening edge of wheelhousing.
9. Remove four screws from inside top of wheelhousing.
10. Remove one screw from the rod securing radiator cradle to fender.
11. Remove one screw holding bumper dampening rod to fender.
12. Remove one screw holding front fender seal to lower bumper.
13. Remove cornering light (Section 12, Note 6), and disconnect the fender marker lamp.
14. Remove two screws holding fender to radiator cradle.
15. Remove 3 screws and shims that hold fender to cowl.

(NOTE: When removing left front fender, disconnect underhood wiring harness from retaining straps on fender.)

16. Remove fender by lifting outward and slightly forward.

b. Installation (Fig. 11-5)

All fender attaching bolts should be loosely installed until fender alignment is obtained. Install the same number of shims at each location as were removed. Then tighten to proper torque specification. Loosen wheelhousing attaching screws if necessary to align fender properly.

1. Position fender in approximate location, being careful not to damage leading edge of door or trailing edge of fender, and if working on left front fender, position underhood wiring harness and hood latch cable to fender reinforcement and secure.
2. Install two screws holding fender to radiator cradle.
3. Install three screws that hold fender to cowl.
4. Connect and install fender marker lamp and cornering lamp (Section 12, Note 6).
5. Install screw holding front fender seal to lower bumper.
6. Install one screw holding bumper dampening rod to fender.
7. Install screw in the rod securing radiator cradle to fender.
8. Install four screws on inside top of wheelhousing.
9. Install five fender attaching screws in wheel opening edge of wheelhousing.
10. Install screw that holds rear bottom of fender to rocker panel.
11. Install screw retaining fender to door at lower hinge pillar.
12. Obtain proper alignment of fender and tighten all screws installed in steps 2 through 11 to proper torque.
13. Position hood and install four bolts holding hood hinges to fenders.
14. Install wheel and rocker panel molding.
15. Install or connect power antenna (Section 12, Note 51), and battery as required.

6. Front Fender Wheelhousing (Right or Left) except Eldorado (Fig. 11-5)

a. Removal

1. Remove front fender as described in Note 1.
2. If working on left side, remove horn from wheelhousing. When removing right wheelhousing, proceed as follows:

a. Remove Automatic Level Control compressor as described in Section 4, Note 24.

b. Remove heater and air conditioner hoses from wheelhousing.

c. Remove battery cable from retaining straps.

BACK TO INDEX

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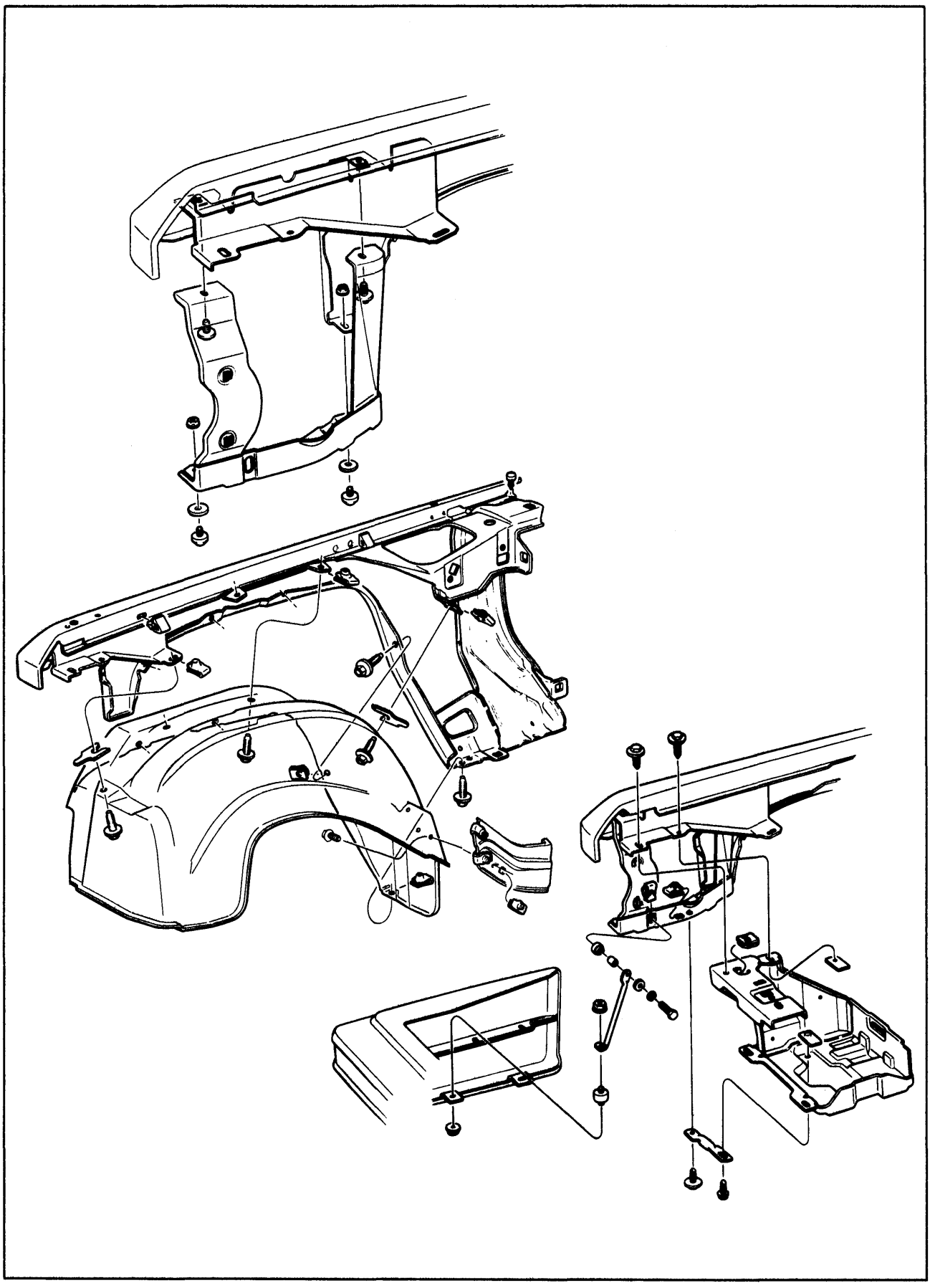


Fig. 11-5 Front Fender Disassembled (Except Eldorado)

BACK TO INDEX

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d. Remove power antenna as described in Section 12, Note 51.

3. Remove two screws and washers securing wheelhousing splash shield to frame.

4. Remove three screws with washers attached at rear of wheelhousing that secure brace to wheelhousing.

5. Remove two screws and tapping plate from brace that secures the front of wheelhousing to cradle.

6. Remove two nuts and washers that secure cowl-to-wheelhousing strut and wheelhousing-to-radiator cover strut to top of wheelhousing. Swing struts out of way.

7. Remove wheelhousing.

b. Installation

1. Position wheelhousing in approximate location and loosely install three screws at rear of wheelhousing that secure rear brace to wheelhousing.

2. Loosely install two nuts and washers on cowl-to-wheelhousing strut. Secure wheelhousing-to-radiator cover strut with one of two nuts.

3. Loosely install two screws and tapping plates securing front of wheelhousing to bracket at radiator cradle mount.

4. If right wheelhousing is being installed, proceed as follows:

a. Install Automatic Level Control compressor as described in Section 4, Note 24.

b. Position and secure heater and air conditioning hoses to wheelhousing.

c. Secure negative battery cable to wheelhousing with two straps.

d. Install power antenna as described in Section 12, Note 51.

5. Install two screws and washers securing wheelhousing splash shield to frame.

6. Check alignment of wheelhousing and tighten all attaching nuts, bolts, and screws.

7. If working on left side, install horn.

8. Install front fender as described in Note 5b.

7. Front Fender (Right or Left) Eldorado

a. Removal (Fig. 11-6)

1. If left fender is to be removed, disconnect negative battery cable and remove hood. If right fender is to be removed, remove coolant reservoir, battery, power antenna, automatic level control compressor, and hood.

(NOTE: Count number of shims at each attachment so that same number are installed during installation.)

2. Apply masking tape to rear edge of fender to avoid scratching finish when removing fender.

3. Raise front of car and remove wheel at fender being replaced.

(NOTE: When removing left front fender, disconnect forward lamp harness from retaining straps on fender reinforcement.)

4. Disconnect wiring connector for parking, turn signal, cornering and side marker lamps. Also remove monitor conductors from headlamp connectors.

5. Remove fender extension. Note 9A.

6. Open door and remove one screw and shims securing lower rear edge of fender inside door opening.

7. Remove seven screws securing rocker panel molding to body and remove molding.

8. Remove one screw, washers and shims securing bottom rear edge of fender to rocker panel.

9. Remove one screw and washer securing lower rear corner of wheelhousing to rocker panel.

10. Remove one screw from front wheelhousing splash shield to fender.

11. Remove three screws, washers and shims securing top rear of fender to cowl under hood.

12. Remove one screw securing fender bracket to side of the radiator cradle.

13. Remove two screws securing top front of fender to radiator cradle.

14. Remove one bolt securing front lower corner of fender to radiator cradle strut rod.

15. Remove six screws securing fender to wheelhousing.

16. Remove two screws securing fender to top of wheelhousing.

17. Remove front fender.

b. Installation (Fig. 11-6)

1. Position fender on car and loosely install two screws securing fender to top of wheelhousing.

(NOTE: When installing left fender make sure wiring harness and hood release cable are routed between fender and wheelhousing.)

2. Loosely install two screws securing fender to top of wheelhousing.

3. Loosely install six screws securing fender to bottom of wheelhousing.

4. Loosely install one bolt and U-nut securing front lower corner of fender to radiator cradle strut rod.

5. Loosely install one screw securing front wheelhousing splash shield to fender.

6. Loosely install one screw securing fender to bracket on side of the radiator cradle.

7. Loosely install three screws, washers and shims securing top rear of fender to cowl under hood.

8. Loosely install one screw and washer securing lower rear corner of wheelhousing to rocker panel.

9. Loosely install one screw securing lower rear corner of fender to rocker panel.

10. Loosely install one screw and shims securing lower rear edge of fender inside door opening.

11. Check alignment and tighten all screws to proper torque.

12. Position rocker panel molding to body and secure with seven screws.

13. Install fender extension. Note 9B.

14. Position and connect wiring connector for parking, turn signal, cornering, and side marker lamps. Also, install monitor conductors into headlamp connectors.

BACK TO INDEX

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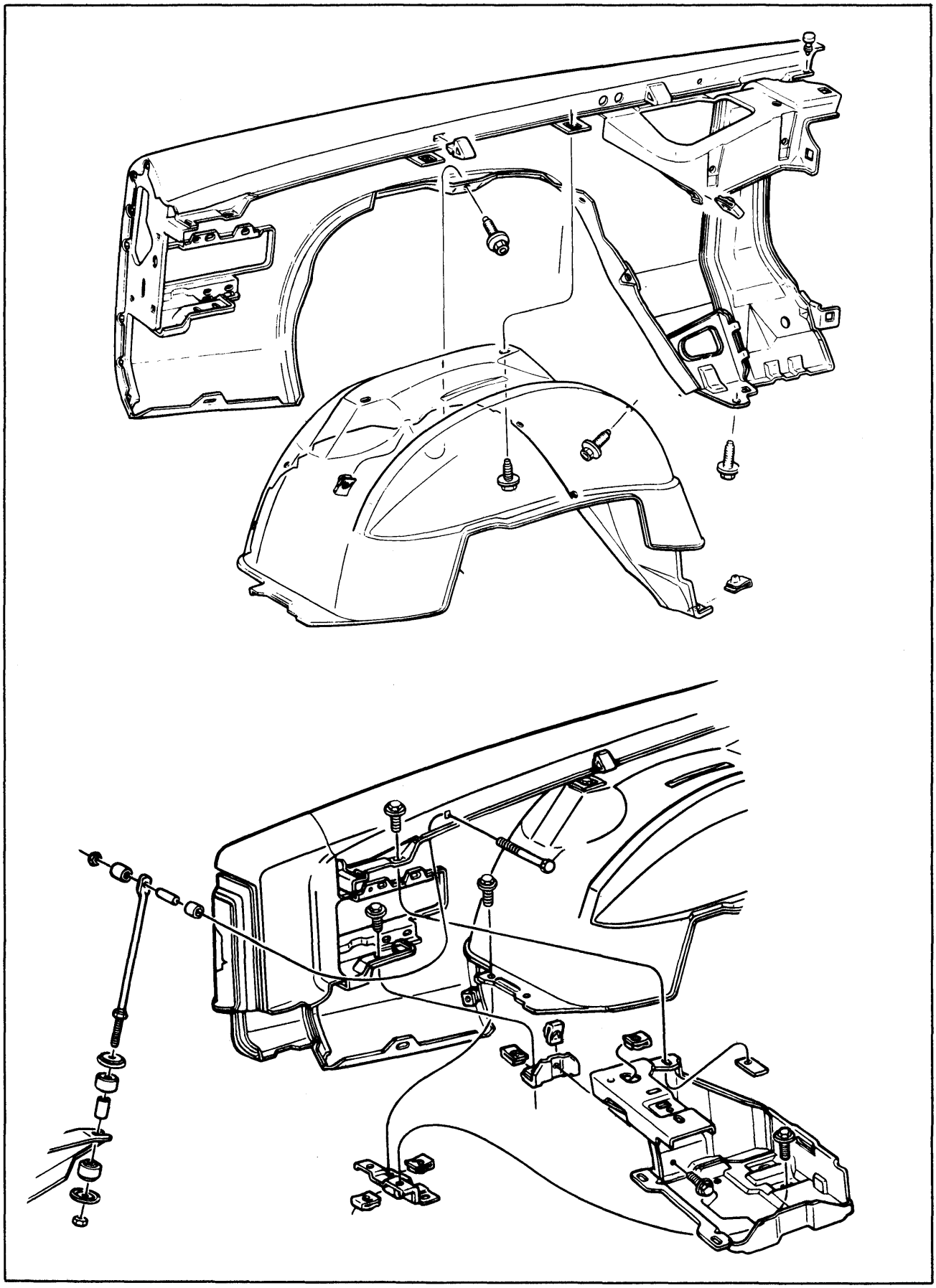


Fig. 11-6 Front Fender Disassembled – Eldorado

BACK TO INDEX

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(NOTE: If installing left front fender, connect underhood wiring harness to retaining straps on fender reinforcement.)

15. With front end of car still raised, install wheel previously removed.

16. Remove masking tape from rear edge of fender.

17. If left fender was removed install negative battery cable and hood. If right fender was removed install battery, power antenna (Section 12, Note 51), automatic level control compressor (Section 4, Note 24) and hood.

8. Front Fender Wheelhousing (Right or Left) Eldorado (Fig. 11-6)

a. Removal

1. Remove fender as described in Note 7.
2. If working on left side, remove horn from wheelhousing. If removing right wheelhousing, remove heater and A/C hoses from clip on wheelhousing and support and position hoses out of way.
3. Remove two screws securing forward portion of wheelhousing to bracket on radiator cradle.
4. Remove one screw from rear wheelhousing splash shield to frame.
5. Remove wheelhousing from car.

b. Installation

1. Position wheelhousing in approximate location.
2. Install one screw securing rear wheelhousing splash shield to frame.
3. Install two screws and tapping plates securing forward portion of wheelhousing to bracket on radiator cradle.
4. If working on left side, position horn to wheelhousing and secure with fastener. If installing right wheelhousing, position heater and A/C hoses beneath clip on side of wheelhousing.
5. Install fender as described in Note 7b.

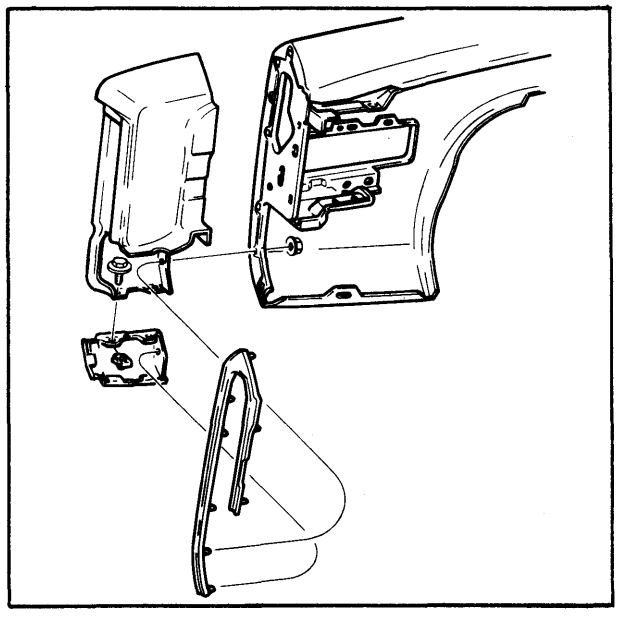


Fig. 11-7 Fender Extension

9. Fender Extension (Right or Left) Eldorado (Fig. 11-7)

a. Removal

1. Remove side marker light (Section 12, Note 13).
2. Remove nine nuts securing fender extension to fender.
3. Pull fender extension forward and up to remove.

b. Installation

1. Position fender extension to fender.
2. Install nine nuts securing fender extension to fender.
3. Install side marker light (Section 12, Note 13).

BACK TO INDEX

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TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot Pounds
275M	Hood Hinge to Fenders	3/8-16	30
275M	Hood Hinge to Hood	3/8-16	30
6010M	Fender to Door	3/8-16	30
275M	Fender to Rocker Panel	3/8-16	20
275M	Fender Edge to Wheelhousing	5/16-18	20
275M	Wheelhousing to Fender	5/16-18	20
275M	Radiator Cradle Bracket to Fender	5/16-18	15
275M	Fender to Radiator Cradle	5/16-18	15
275M	Fender to Cowl	3/8-16	30
275M	Secondary Latch to Hood	5/16-18	20
275M	Primary Latch to Tie Bar	5/16-18	20
6010M	Wheelhousing Splash Shield to Frame	5/16-12	10
275M	Wheelhousing to Brace	5/16-18	20
275M	Wheelhousing to Cradle	5/16-18	15
286M	Strut to Wheelhousing Nut	5/16-18	20
284M	Fender Extension to Fender	10-24	25 in. lbs.
6010M	Fender Seal to Bumper	1/4-14	15 in. lbs.
Eldorado			
275M	Fender to Cradle Strut Rod	5/16-18	15
275M	Wheelhousing to Fender	5/16-18	20

CAUTION: These hood latch assembly fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with equivalent parts if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

BACK TO INDEX

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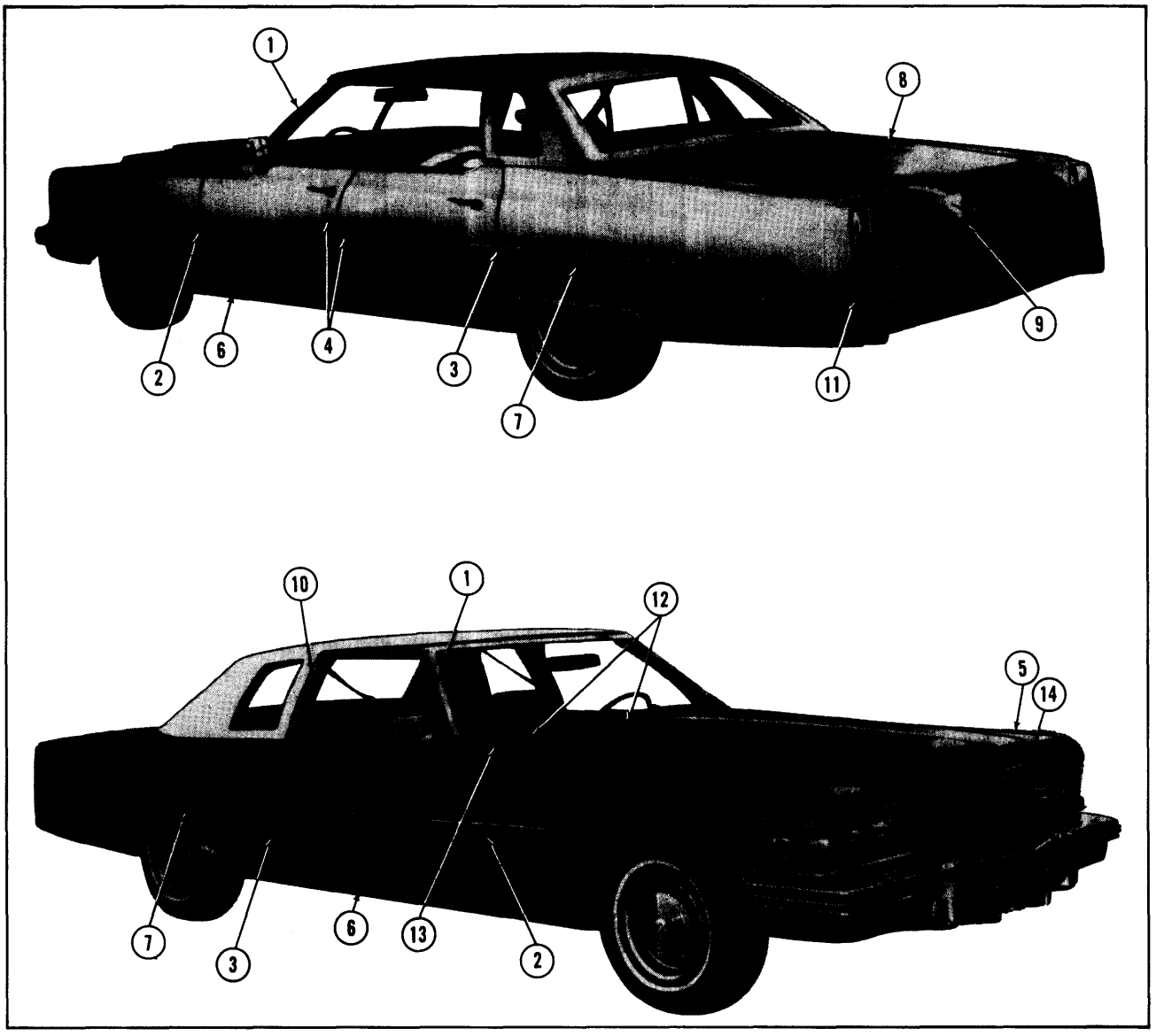


Fig. 11-8 Sheet Metal Tolerances (Except Eldorado)

SHEET METAL TOLERANCES (EXCEPT ELDORADO)

Location	Style	Clearance Gap"	Flushness
1. Side window to windshield	All except	3/8-7/16	—
	23 and 33	1/8-1/4	—
2. Door to Fender	All	7/32-9/32	3/32 +.00
3. Door to Quarter Panel	All	1/8-1/4	+0-1/16
4. Front Door to Rear Door	All	1/8-1/4	+0-1/16
5. Hood to Fender	All	1/8-5/32	±1/16
6. Door to Rocker Panel	All	1/8-1/4	—
7. Wheel Skirt to Quarter Panel	All	1/8-1/4	±1/16
8. Trunk Lid to Fender	All	1/16-1/4	±1/16
9. Trunk Lid to Bumper	All	1/2-3/4	—
10. Windows	49, 47 & 67 only	5/16-3/8	*
11. Bumper to Quarter Panel	All	1-23/32-1-31/32	—
12. Hood to Windshield Wiper Arm	All	1/8 Min.	—
13. Hood to Door	All	7/32-9/32	±1/16
14. Hood to Grille	All	19/32-3/4	—

*May be out of plane if weatherstrip provides watertight seal.

BACK TO INDEX

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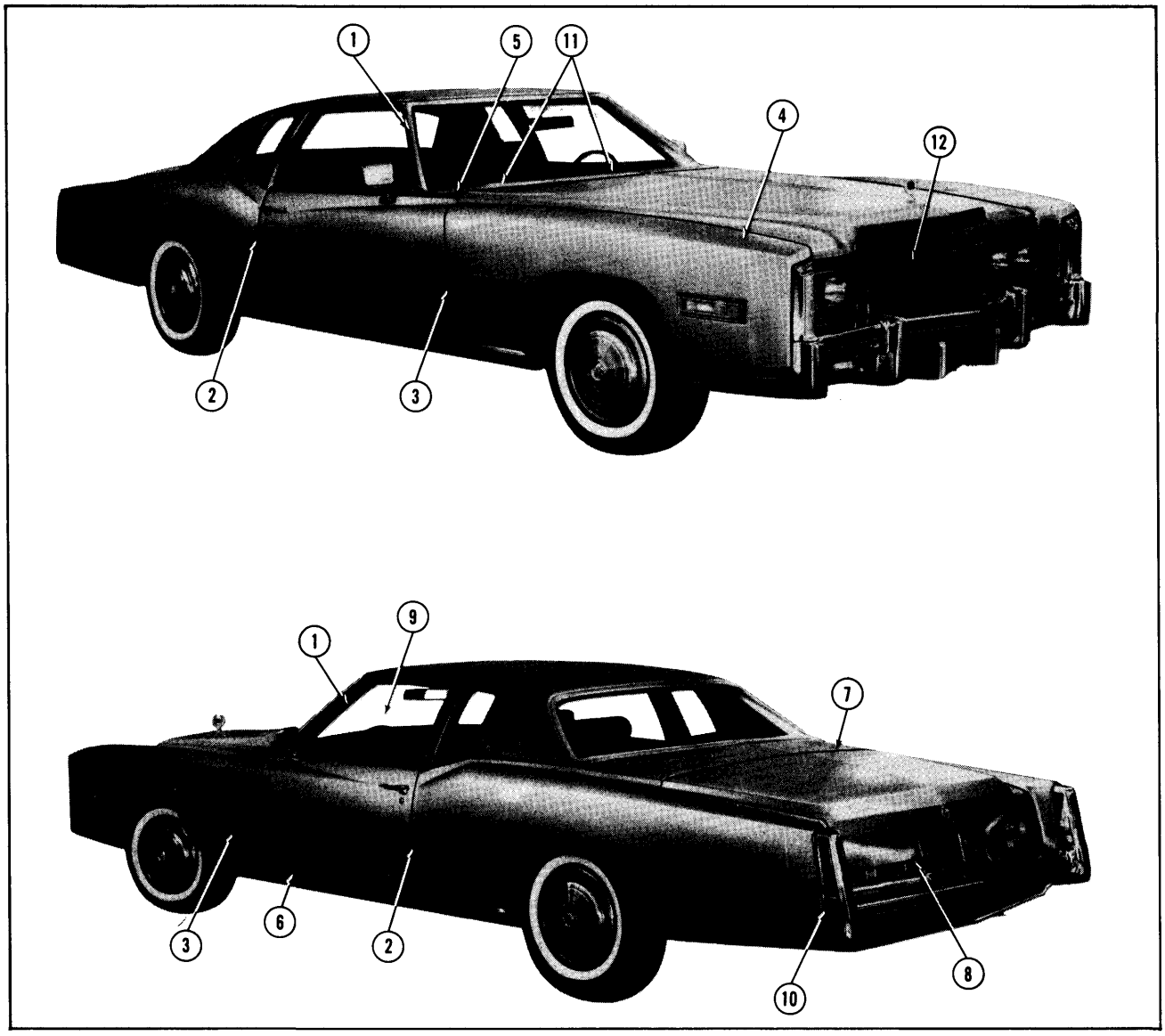


Fig. 11-9 Sheet Metal Tolerances — Eldorado

SHEET METAL TOLERANCES — ELDORADO

Location	Tolerance"	Flushness
1. Side window to windshield	3/8-7/16	—
2. Door to Quarter Panel	7/32-9/32	± 1/16
3. Door to Fender	7/32-9/32	± 1/16
4. Fender to Hood Panel Rear Extension	1/8-1/4	± 1/16
5. Hood to Door Hood Panel Rear Extension	7/32-9/32	± 1/16
6. Door to Rocker Panel	1/8-1/4	—
7. Trunk lid to Fender	1/16-1/4	± 1/16
8. Trunk lid to Bumper	1/2-3/4	—
9. Windows	5/16-3/8	*
10. Rear Bumper to Fender	1-23/32-1-31/32	—
11. Hood to Windshield Wiper Arm	1/8 Min.	—
12. Hood to Grille	19/32-3/4	—

*May be out of plane if weatherstrip provides watertight seal.

BACK TO INDEX

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TABLE OF CONTENTS

Subject	Page No.
Lighting Systems	
General Description	12-2
Diagnosis	12-3
Service Information	
Headlamp Aiming	12-9
Removal and Installation	12-13
Bulb Replacement	12-21
Bulb Data Chart	12-22
Wiring and Circuit Protection	
Splicing Aluminum Solid Core Wire	12-25
Circuit Protection Location Chart	12-26
Replacing Fusible Links	12-27
Electrical Instruments	
General Description	12-28
Diagnosis	12-29
Fuel Gage and Float Unit	12-29
Telltale Lamps	12-31
Horns	12-36
Digital Clock	12-38
Service Information	
Turn Signal Switch	12-38
Standard Steering Column	12-38
Tilt and Telescoping Column	12-39
Back-Up Light Switch	12-40
Lamp Monitor System	12-41
Windshield Wiper System (Mist)	12-42
Washer Fluid Low Level Indicator	12-43
Radio and Antenna	12-45
Instrument Panel	12-61
Wiring Circuit Diagrams	12-81
Chassis Wiring Circuit Diagram	Rear Gatefold

BACK TO INDEX

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WARNING: IF EQUIPPED WITH AIR CUSHION RESTRAINT SYSTEM DO NOT ATTEMPT ANY ADJUSTMENT REPAIR OR REMOVAL OF ANY PORTION OF THE ELECTRICAL SYSTEM WHICH WOULD REQUIRE REMOVAL OR DISCONNECTING OF ANY COMPONENT OF THE AIR CUSHION RESTRAINT SYSTEM UNTIL THE DISCONNECTION PROCEDURE IS COMPLETED. THIS PROCEDURE MUST BE FOLLOWED TO PREVENT ACCIDENTAL DEPLOYMENT OF THE SYSTEM WHICH COULD RESULT IN PERSONAL INJURY AND/OR DAMAGE TO THE SYSTEM'S COMPONENTS.

A.C.R.S. DISCONNECTION PROCEDURE

Turn ignition switch to "LOCK" position. Disconnect the negative battery cable from the battery and tape end.

GENERAL DESCRIPTION

Headlamps

All Cadillacs feature the four lamp rectangular headlamp system. The rectangular headlamps are approximately six and three-eights inches wide by four inches high.

The rectangular shape offers a distinctive appearance. The lower height allows the possibility of a smaller overall frontal area. This is accomplished with no reduction in total headlamp candlepower output.

Although the rectangular headlamp unit bulb numbers are 4652 low beam and 4651 high beam they may also be identified by a code on the lens. 1A identifies the lamp as an inner or high beam unit while 2A indicates that the lamp is an outer or low beam unit. The identification is located to the left of the upper headlamp aiming guide point.

Mechanical aiming of the headlamps must be done with J-25300 headlamp aiming tool, Fig. 12-1. Aimers J-25300-1 and J-25300-2 when used with the two J-25300-6 adapters eliminate the need for a separate transit and target. When used with adapters J-25300-3 the aimers can be used to adjust the rectangular headlamps. Adapters J-25300-5 or J-25300-4 can easily be attached to the aimers to allow the tool to be used on five inch and seven inch round headlamps respectively.

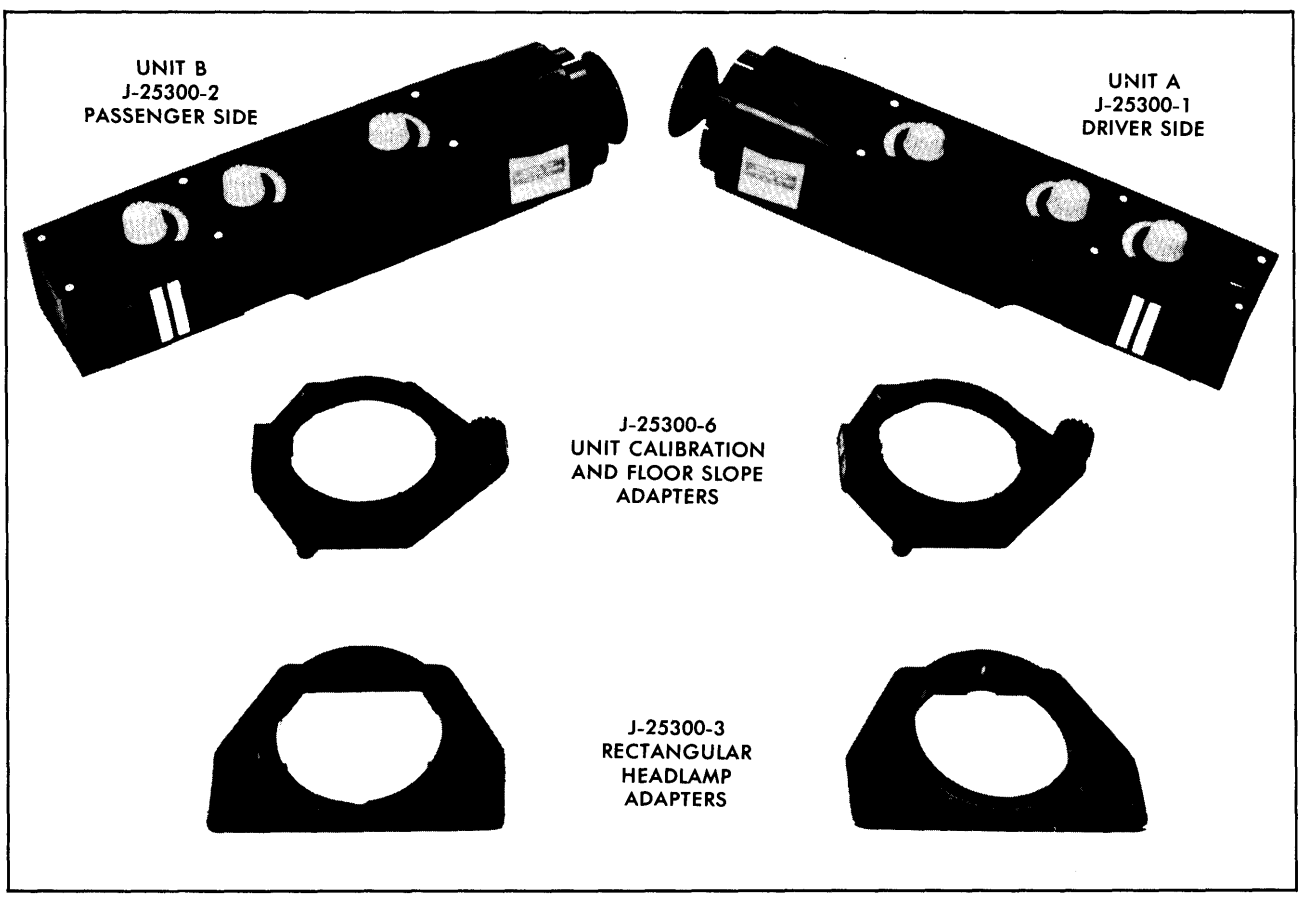


Fig. 12-1 Headlamp Aiming Tool J-25300

BACK TO INDEX

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Lamps and Bulbs

Rearrangement of existing telltale lamp locations and the addition of new indicators have changed many bulb requirements. The bulb data chart located on page 12-23 contains a complete listing of these and all other bulbs.

Instrument panel courtesy lamp bulbs are the push-in wedge type. A one piece courtesy lamp housing and shield is used.

Wiring

Chassis wiring is modified to include two twenty-eight pin bulkhead connectors. One is located on the back of the fuse panel. The second bulkhead connector is located on the center of the fire-wall behind the air conditioning and heater case assembly. Separate grommets are used only when the car is equipped with trackmaster, guide matic, or electronic fuel injection.

A complete full color chassis circuit wiring diagram is located on the rear gatefold.

HEADLIGHTS DIAGNOSIS

POSSIBLE CAUSE	CORRECTIVE ACTION
ONE HEADLIGHT INOPERATIVE OR INTERMITTENT	
Loose connection.	Secure connections to sealed beam including ground (black wire).
Problem in sealed beam.	Replace.
ONE OR MORE HEADLIGHTS ARE DIM	
Open ground connection at headlight.	Repair black wire connection between sealed beam and chassis ground.
Black ground wire mislocated in headlight connector (Type 2A Sealed Beam).	Relocate.
ALL HEADLIGHTS INOPERATIVE OR INTERMITTENT	
Loose connection.	Check and secure connections at foot switch, guide matic relay and headlamp switch and ground wire connections.
Malfunctioning foot switch.	Check voltage at foot switch with test bulb. If bulb lights only at light blue wire terminal, replace foot switch.
Open wiring – light switch to foot switch.	Check voltage at light blue wire with test bulb. If bulb lights at headlamp switch light blue wire terminal but not at foot switch, repair open in light blue wire.
Open wiring – light switch to battery.	Check voltage at headlamp switch yellow wire terminal with test bulb. If bulb fails to light, repair open yellow wire circuit to battery (possible open dark green fusible link at starter).
Circuit shorted to ground.	If, after a few minutes operation, headlights cycle on and off and/or a clicking noise can be heard from the headlamp switch (circuit breaker opening and closing), repair short to ground in circuit between headlamp switch, dimmer switch and headlights. After repairing short, check for headlight flickering after one minute operation. If flickering occurs, the circuit breaker has been damaged and headlamp switch must be replaced.
Malfunctioning light switch.	Check voltage at headlamp switch yellow and blue wire terminals with test bulb. If bulb lights at yellow wire terminal but not at light blue, replace light switch.

BACK TO INDEX

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HEADLIGHTS DIAGNOSIS (CONT'D.)

POSSIBLE CAUSE	CORRECTIVE ACTION
UPPER OR LOWER BEAM WILL NOT LIGHT OR INTERMITTENT	
Open connection or malfunctioning foot switch.	Check voltage at foot switch headlight terminals with test light. If bulb lights at headlight terminals (light green - High Beam, Tan - Low Beam), repair open wiring between foot switch and headlights. If bulb will not light at one of the foot switch headlight terminals, replace foot switch.
Circuit shorted to ground.	Follow diagnosis shown above under "All Headlights Inoperative or Intermittent."
Problem in sealed beam.	Replace.

TURN SIGNAL AND HAZARD WARNING LAMPS DIAGNOSIS

TURN SIGNAL INOPERATIVE – ONE SIDE	
Bulb out (flasher cannot be heard).	Turn on hazard warning system. If one or more lamps do not operate, check for a malfunctioning bulb.
Open wiring or ground connection.	Turn on hazard warning system. If one or more bulbs do not operate, use 12 volt test lamp to check voltage at lamp socket. If test bulb lights, repair open ground connection. If not, repair open wiring between bulb socket and turn signal switch.
Improper bulb or malfunctioning turn signal switch.	Turn on hazard warning system. If all front and rear lamps operate, check for imporper bulb (1157 in rear and Eldorado front, and 1157 NA in front exc. Eldorado). If bulbs are ok, replace malfunctioning turn signal switch.
Short to ground (flasher can be heard, but no lamps operate).	Locate and repair short to ground by disconnecting front and rear circuits separately.
TURN SIGNALS INOPERATIVE – BOTH SIDES	
Open fuse (turn signal).	Turn on hazard warning system. If all lamps operate, replace turn signal fuse if blown. If new fuse blows, repair short to ground between fuse, turn signal switch and lamps.
Malfunctioning flasher (located on lower steering column cover reinforcement between steering column and park brake pedal mechanism).	If turn signal fuse is OK, and hazard warning system will operate lamps, replace turn signal flasher (on lower steering column reinforcement between steering column and park brake pedal mechanism).
Loose connection.	Secure steering column connector. If test bulb lights only on one side of purple wire terminals in connector, clean or tighten connector contacts.
Open wiring or malfunctioning turn signal switch.	If test bulb lights when connected to both sides of purple wire connection in steering column connector, replace turn signal switch. If test bulb does not light on either side of the connector, repair open circuit between fuse and connector.

BACK TO INDEX

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TURN SIGNAL AND HAZARD WARNING LAMPS DIAGNOSIS (CONT'D.)

POSSIBLE CAUSE	CORRECTIVE ACTION
HAZARD WARNING LAMPS INOPERATIVE	
Open fuse (stop-hazard).	Switch on turn signals. If lamps operate, replace stop-hazard fuse if blown. If new fuse blows, repair short to ground. (Could possibly be in stop light circuit).
Malfunctioning flasher (located on fuse panel).	If stop-hazard fuse is OK, switch on turn signals. If lamps operate, replace hazard flasher (on fuse panel).
Open wiring or malfunctioning turn signal switch.	With 12 volt test bulb, check voltage at brown wire in turn signal steering column connector. If test bulb does not light on either side of connector, repair open circuit between flasher and connector. If test bulb lights only on feed side of connector, clean connector contacts. If test bulb lights on both sides of connector, replace turn signal switch assembly.

CORNERING LAMPS DIAGNOSIS

ONE LAMP INOPERATIVE	
Loose connection.	Secure connector near lamp.
Bulb out.	Replace burned out bulb.
Open ground connection.	If bulb is known good and test bulb lights at connector near lamp, repair open ground.
Open wiring.	If test bulb lights on both sides of steering column connector, repair open wiring between connector and lamps. If not, check for open at connector.
Malfunctioning directional signal switch.	If test bulb lights at brown wire terminals of steering column connector but not at gray (left turn) or black/white wire (right turn) terminal, replace directional signal switch.
BOTH LAMPS INOPERATIVE	
Tail lamp fuse blown.	If tail lamps do not light, replace tail lamp fuse if blown. If new fuse blows, repair short to ground between fuse and lamps.
Cornering-park lamp fuse blown.	If the cornering and park lamps do not light, and the tail lamps do light, replace cornering and park lamp fuse. If new fuse blows, repair short to ground between fuse and lamps.
Loose connection.	Secure connectors at headlamp switch and steering column.
Open wiring.	If tail lamps light, check voltage at steering column connector brown wire. If test bulb lights on lamp side of connector only, repair connector terminal. If tail lamps do not light, check for open wiring between headlamp switch and battery. (Possible open fusible link in yellow wire at starter).
Malfunctioning directional signal switch.	If tail lamps light, and test bulb lights on both sides of steering column connector, replace directional signal switch.
Malfunctioning light switch.	If tail lamps do not light and test bulb lights at light switch terminal #5 but not at #4, replace light switch.

BACK TO INDEX

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SIDE MARKER LAMPS DIAGNOSIS

POSSIBLE CAUSE	CORRECTIVE ACTION
ONE LAMP INOPERATIVE	
Side marker bulb out.	Replace burned out bulb.
Loose connection or open wiring.	Check for voltage at bulb socket brown wire terminal with test bulb. If bulb lights, repair open ground circuit. If bulb does not light, repair open brown wire circuit.
FRONT OR REAR LAMPS INOPERATIVE	
Loose connection or open ground connection.	If associated tail or park lamps do not operate, check for loose connector or an open in brown wire circuit. If park lamps operate, repair open ground.
Multiple bulbs out.	Replace burned out bulbs.
ALL LAMPS INOPERATIVE	
Tail lamp fuse blown.	If park and tail lamps do not operate, replace tail lamp fuse if blown. If new fuse blows, check for short to ground between fuse panel and tail lamps.
Cornering-park lamp fuse blown.	If the side marker and park lamps do not light, and tail lamps do light, replace cornering and park lamp fuse. If new fuse blows, repair short to ground between fuse and lamps.
Loose connection.	Secure connector to headlamp switch.
Open wiring.	Check for voltage at tail lamp fuse with test bulb. If bulb lights, repair open wiring between fuse and light switch. If not, repair open wiring between fuse and battery. (Possible open fusible link in yellow wire at starter).
Malfunctioning light switch.	If test bulb lights at light switch terminal #5 but not at terminal #4, replace light switch.

BACK TO INDEX

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TAIL, PARK, AND LICENSE LAMPS DIAGNOSIS

POSSIBLE CAUSE	CORRECTIVE ACTION
ONE SIDE INOPERATIVE	
Bulb out.	Replace.
Open ground connection at bulb socket or ground.	Check for voltage at bulb socket brown wire terminal with test bulb. If bulb lights, repair open ground circuit. If bulb does not light, repair open brown wire circuit.
BOTH SIDES INOPERATIVE	
Tail lamp fuse blown.	Replace fuse. If new fuse blows, repair short to ground in brown wire circuit between fuse panel through headlamp switch to tail lamps.
Cornering-park lamp fuse blown.	If the park lamps do not light and the tail lamps do light, replace cornering-park lamp fuse. If new fuse blows, repair short to ground between fuse and park lamps.
Loose connection.	Secure connector to headlamp switch.
Open wiring.	If test bulb does not light on either side of fuse, repair open circuit between fuse panel and battery. (Possible open fusible link.) If test bulb lights at headlamp switch light green/black wire terminal (5), repair open wiring between headlamp switch and lamps.
Multiple bulb burnout.	If test bulb lights at lamp socket brown wire terminal, replace bulbs.
Malfunctioning headlamp switch.	If test bulb lights at headlamp switch terminal #4 (dark green) but not at terminal #5 (light green/black), replace light switch.

BACK TO INDEX

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STOP LAMPS DIAGNOSIS

POSSIBLE CAUSE	CORRECTIVE ACTION
ONE BULB INOPERATIVE	
Bulb out.	Replace bulb.
ONE SIDE INOPERATIVE	
Loose connection, open wiring, or malfunctioning bulbs.	Turn on directional signal. If lamp does not light, check bulbs. If bulbs are OK, secure all connections. If lamp still does not light, check with a test bulb at green or yellow wire at bulb socket terminals. If bulb lights, repair open in ground circuit.
Malfunctioning directional signal switch or cancelling cam.	If lamp will operate by turning on directional signal. Replace cancelling cam or directional signal switch.
ALL INOPERATIVE	
Stop-hazard fuse blown.	Replace. If new fuse blows, repair short to ground in circuit between fuse and lamps.
Stop switch misadjusted or malfunctioning.	With test bulb check voltage with brake pedal depressed at white wire terminal in steering column connector. If bulb does not light, check stop switch for proper adjustment. If adjustment is OK, replace stop switch.
WILL NOT TURN OFF	
Stop switch misadjusted or malfunctioning.	Readjust properly. If switch still malfunctions, replace.

BACK TO INDEX

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BACK-UP LAMPS DIAGNOSIS

POSSIBLE CAUSE	CORRECTIVE ACTION
ONE LAMP INOPERATIVE OR INTERMITTENT	
Open ground connection.	Repair bulb ground through lamp mounting.
Loose connection.	Tighten connectors.
Bulb out.	Replace bulb.
BOTH LAMPS INOPERATIVE OR INTERMITTENT	
Fuse blown.	Replace fuse. If new fuse blows, repair short to ground in circuit from fuse through back-up lamp switch to back-up lamps.
Loose connection or open circuit.	Secure all connectors. If OK, check continuity by voltage checking circuit from fuse to lamps with test bulb. If test bulb does not light on either side of fuse, check for open circuit from ignition switch to fuse.
Back-up lamp switch misadjusted (open when shift lever is in reverse position).	Adjust switch.
Malfunctioning back-up lamp switch.	With ignition on, check voltage at terminals with switch in back-up position. If bulb lights at dark green wire terminal but not at light green wire terminal, replace back-up lamp switch.
Malfunctioning ignition switch.	If test bulb lights at ignition switch battery terminal but not at output terminal, replace ignition switch.
LAMPS WILL NOT TURN OFF	
Back-up lamp switch misadjusted (closed when shift lever is not in reverse position).	Adjust switch.

SERVICE INFORMATION

1. Headlamp Aiming—Mechanical Aimer Method

a. Adjusting Aimer to Floor Level

(NOTE: To obtain accurate headlamp aim, the car must be placed on a flat surface. The surface need not be exactly level.)

1. Drive car onto selected area.
2. Attach one floor compensation and calibration adapter J-25300-6 to each aimer unit A and B (J-25300-1 and J-25300-2).
3. Place aimers at the center line of each wheel on the passenger side of the car as shown, in Fig. 12-2.

Place Unit B (J-25300-2) at the FRONT wheel
Place Unit A (J-25300-1) at the REAR wheel

BACK TO INDEX

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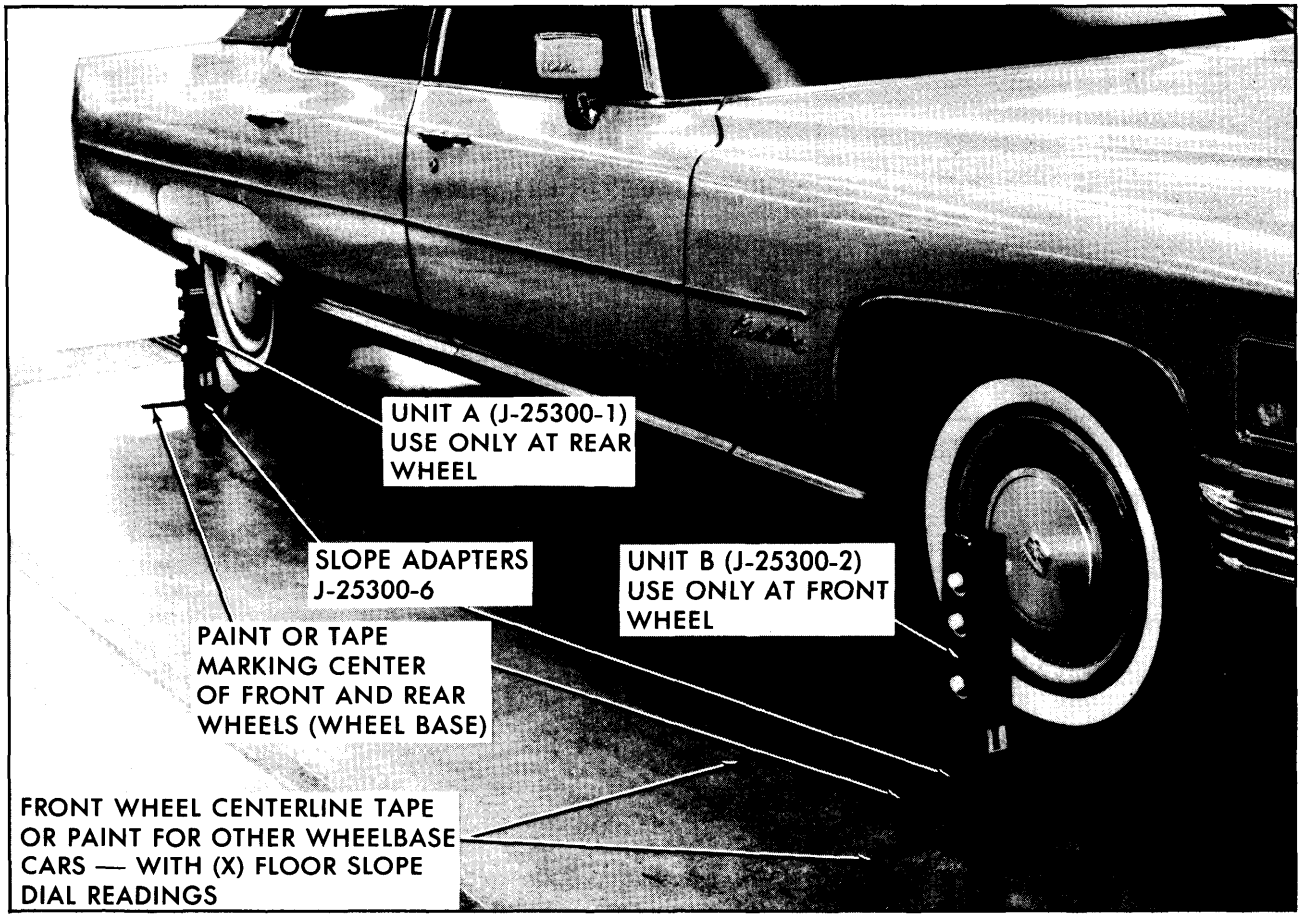


Fig. 12-2 Checking Floor Slope

4. Adjust floor slope compensation knob on each adapter until the level bubble on each aimer is in the centered or level position, Fig. 12-3.

5. Look into floor slope target viewing porthole on either unit and turn horizontal adjuster knob until split image is aligned.

6. Read horizontal dial, set floor slope knob (Fig. 12-3) to this reading, and reset horizontal knob to zero.

7. Repeat steps 5 and 6 at other wheel (Readings should be nearly equal – if they are not it is an indication that the aimers should be calibrated).

8. Remove floor compensation adapters from aimers.

(NOTE: The aimers are now adjusted for the slope of the floor on which the vehicle is positioned. With tape or paint mark the centerline of the rear wheel on the floor. Mark on the floor the centerline of the front wheel along with the plus or minus reading from the floor slope dial. For cars with a different length wheel base repeat steps 1 through 8 after positioning the rear wheels on the centerline mark. Mark the different front wheel centerlines and dial readings. Repeat for different wheel base lengths. The floor slope offset dial may now be immediately set to the mark next to the centerline of the front wheels of each following car, Fig. 12-2.)

If the floor is abnormally sloped, perform Steps 3 through 8 on BOTH sides of the car and average the two dial readings. Both slope offset dials must then be set at the average reading of the two sides.

(NOTE: When aimers are positioned to calibrate floor slope passenger side aimer unit B (J-25300-2) must ALWAYS be placed at the FRONT wheel. Driver side aimer unit A (J-25300-1) must ALWAYS be placed at the REAR wheel. (This will position the adjustment knobs toward the wheel when used on the driver's side). If aimers are reversed the slope reading will be positive instead of negative or negative instead of positive.)

b. Headlamp Adjustment

1. Adjust tire pressure as recommended in Section 10. Make certain car is at normal standing height as described in Section 3.

2. Check headlamps for correct operation. All four rectangular headlamps operate during high beam operation and the two outer lamps only during low beam operation. Turn off lamps before adjusting.

3. Check floor slope and set floor slope knobs as described in part A.

4. Clean headlamp lenses.

5. Attach rectangular adapters J-25300-3 to aimers J-25300-1 and J-25300-2.

6. Attach aimer J-25300-2 onto passenger outer lamp making certain that the three guide points on the lamp contact the three steel inserts inside the adapter. Push piston handle forward until vacuum cup tightly

BACK TO INDEX

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Fig. 12-3 Correcting for Floor Slope

engages lens and then rapidly pull back piston handle until it locks in place. Attach aimer J-25300-1 to driver outer lamp, Fig. 12-4.

7. Set horizontal and vertical dials to zero. Rotate each aimer as necessary to locate split image target lines, Fig. 12-4.

8. Turn HORIZONTAL adjusting screw at side of headlamp until split image of target line appears as one line, Fig. 12-5.

(NOTE: Always make final adjustment by turning screw in a clockwise direction.)

Repeat adjustment on opposite headlamp.

9. Turn VERTICAL adjusting screw at top of headlamp until the level bubble is centered between the lines.

(NOTE: Individual state laws may vary and local authorities should be consulted for regulations on dial settings.)

(NOTE: Always make final adjustment by turning screw in a clockwise direction.)

Repeat adjustment on opposite headlamp.

10. Recheck target alignment on each side and readjust horizontal aim if necessary.

11. Hold aimer securly and release by pushing vacuum release button located on piston handle.

12. Repeat HORIZONTAL and VERTICAL adjustments for inner headlamps.

c. Calibrating Aiming Units

Aimers J-25300-1 and J-25300-2 are calibrated for use on a level floor prior to shipment from the manufacturer. The calibration should be checked after extended use (check local regulations) or after either unit is dropped or damaged.

1. Using a carpenter or stone mason spirit level locate a vertical plate glass window.

2. Attach calibration adapters J-25300-6 to aimers with level vial facing top of unit. Turn adapter adjusting screws until the threads extend approximately the same distance as the adapter support posts.

3. Secure aimers and adapters to the plate glass window using the same procedure as attaching the aimers to headlamps. The aimers should be three to five feet apart with targets facing each other.

4. Set the floor slope dial on each aimer to zero, Fig. 12-5.

5. Adjust the compensating knob on each adapter until the level vials are centered, Fig. 12-3.

6. After adjusting adapter level vials, turn VERTICAL dial knob on each aimer until aimer level vials are centered. If aimer vertical dial pointers are between 1/2 "Up" and 1/2 "Down" units are within VERTICAL calibration limits, Fig. 12-5.

7. Adjust HORIZONTAL dial knob on each aimer until split image targets align. If aimer horizontal dial pointers are between "1" left and "1" right units are within HORIZONTAL calibration limits.

8. If aimer units are not within specifications adjust VERTICAL aim calibration by inserting a 3/64 inch allen wrench into the adjusting hole in the vertical dial, Fig. 12-5. Turn wrench until the level vial is centered. Repeat on second aimer.

Adjust HORIZONTAL aim calibration by inserting a screwdriver into split image adjusting screw on right side of aimer, Fig. 12-5. Turn screw until split image aligns. Repeat on second aimer.

2. Headlight Aiming—Screen Method

The factory recommended headlight aiming specifications for the screen method are shown in Fig. 12-6. Individual State laws vary and dealers should check with local authorities.

a. Screen Diagram

Make a headlight aiming screen according to the dimensions and layout shown in Fig. 12-6.

b. Equipment Set-Up

Make sure headlight aiming screen is mounted at a point where there will be an ample level area in front of screen. It is important that floor at aiming screen is at same level as the floor at the point where car is positioned.

BACK TO INDEX

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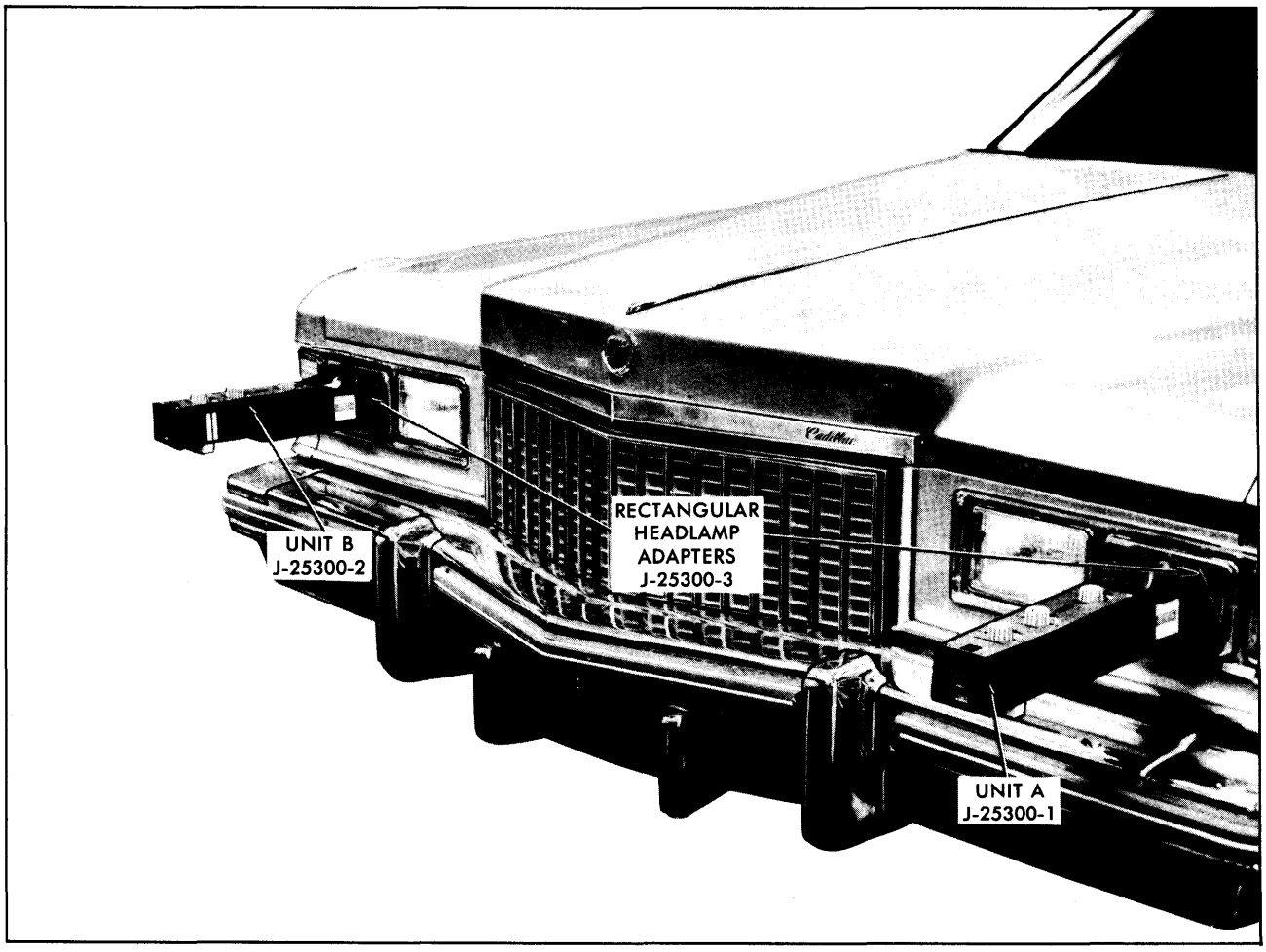


Fig. 12-4 Aiming Headlamps

c. Headlight Adjustment

1. Position car so that headlights are exactly 25 feet from aiming screen and car is in line with centerline on screen. To position car, sight through rear window, lining up centerline of rear window reveal molding escutcheon with inside rear view mirror bracket and car centerline on screen.

2. Position two 36 inch sticks vertically at the left front and left rear wheels. Sight over sticks and move left side of screen up or down, as required, to line up horizontal headlight centerline on screen with the 36 inch sight line. Follow same procedure on right side.

3. Mark wall adjacent to horizontal centerline of headlight line on aiming screen. Subtract the curb height from 36. Using the new dimension, mark down on the wall from the 36 inch mark.

Move screen down until horizontal centerline of headlight is even with this point.

4. Set headlights on high beam. Make sure all four headlights are on.

5. Cover both left side headlights and right side outer light and adjust right inner light as required until pattern centers at point "B" on screen, Fig. 12-6.

6. Cover both right side headlights and left side outer light and adjust left inner light as required until pattern centers as point "C" on screen, Fig. 12-6.

Series	Rear Suspension	Curb Height @ ℄ Headlamps	
		Inches	Centimeter
Brougham	All	27.66	70.26
Calais, DeVille	Std.	27.52	69.90
	A.L.C.	27.74	70.46
75 Series	Sedan	28.02	71.17
	Limousine	27.67	70.28
Eldorado	All	26.25	66.68
Commercial Chassis	All	27.79	70.59

7. Set headlight on low beam. Only outer headlights should light.

8. Cover left outer headlight and adjust right outer light as required until top of pattern "D" is on horizontal centerline of headlight and left edge of pattern is on vertical centerline of outer light, Fig. 12-6.

9. Cover right outer headlight and adjust left outer light as required until top of pattern "E" is on horizontal centerline of headlight and left edge of pattern is on vertical center line of outer light, Fig. 12-6.

BACK TO INDEX

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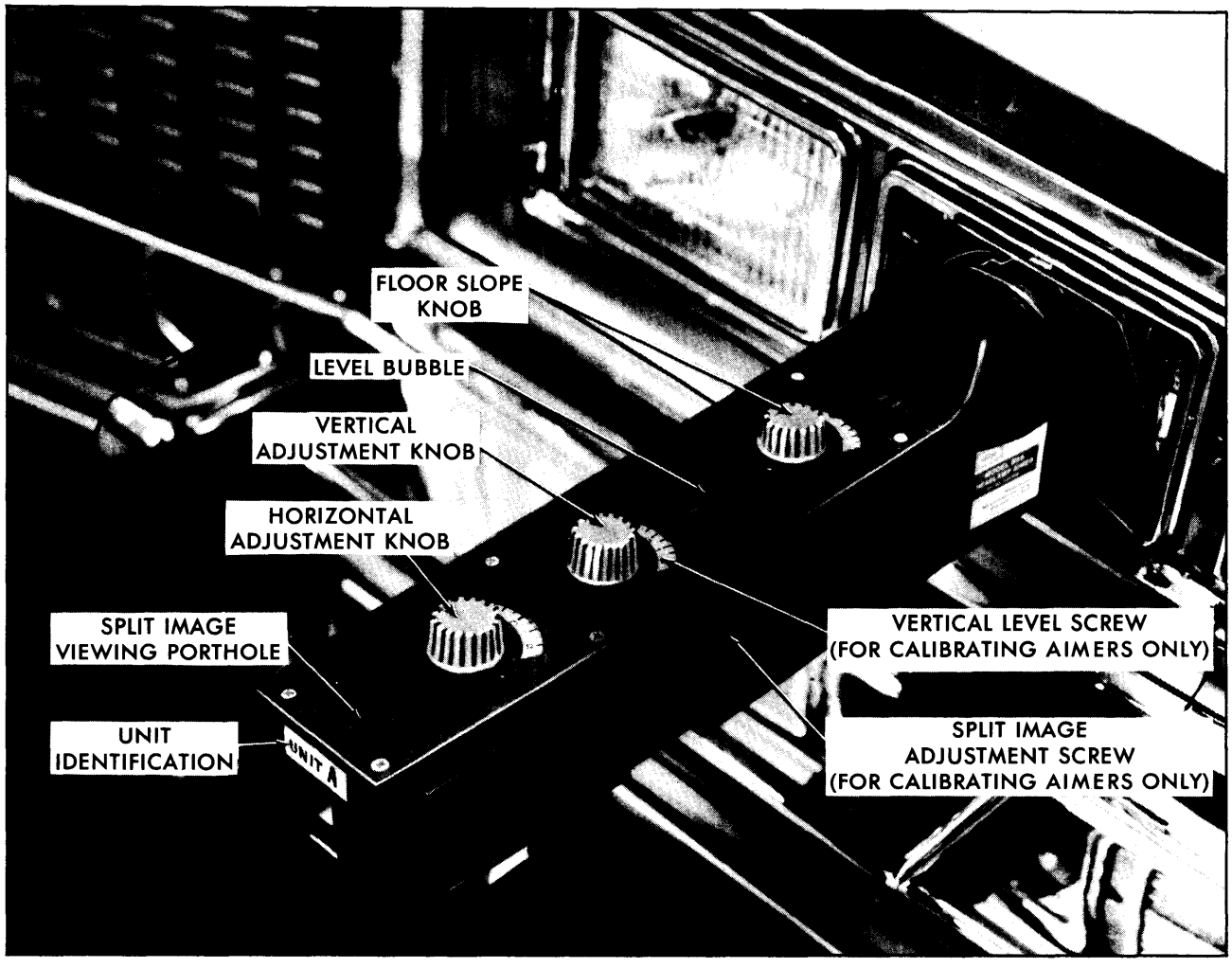


Fig. 12-5 Aimer Unit Parts Identification

3. Headlamp Replacement (Exc. Eldorado) (Fig. 12-7)

a. Removal

1. Remove 4 screws securing headlamp Bezel to headlamp housing. Grasp headlamp Bezel near grille and pivot outward to remove from under cornering lamp.
2. Remove 4 screws securing headlamp retaining ring to mounting ring.
3. Disconnect electrical and lamp monitor connectors and remove lamp.

b. Installation

1. Connect electrical and lamp monitor connectors.
2. Position headlamp into mounting ring.
3. Install headlamp retaining ring and secure with 4 screws.
4. Position outboard edge of headlamp Bezel under edge of cornering lamp. Align headlamp Bezel and secure with 4 screws.
5. Check operation of headlamp and lamp monitors.
6. Aim headlamps as described in Note 1 or 2.

4. Headlamp Housing Assembly (Fig. 12-7)

a. Removal

1. Disconnect negative battery cable.
2. Using a twelve inch socket extension and working through holes in top of radiator cradle loosen, but do not remove, 2 lower screws which secure headlamp housing to radiator cradle, Fig. 12-7 (Fig. 12-11 Eldorado).
3. Loosen upper screw and remove shims. Note number and position of shims.
4. Remove upper screw and gently slide headlamp housing foreward.
5. Remove electrical and lamp monitor connectors.
6. Remove housing assembly.

b. Installation

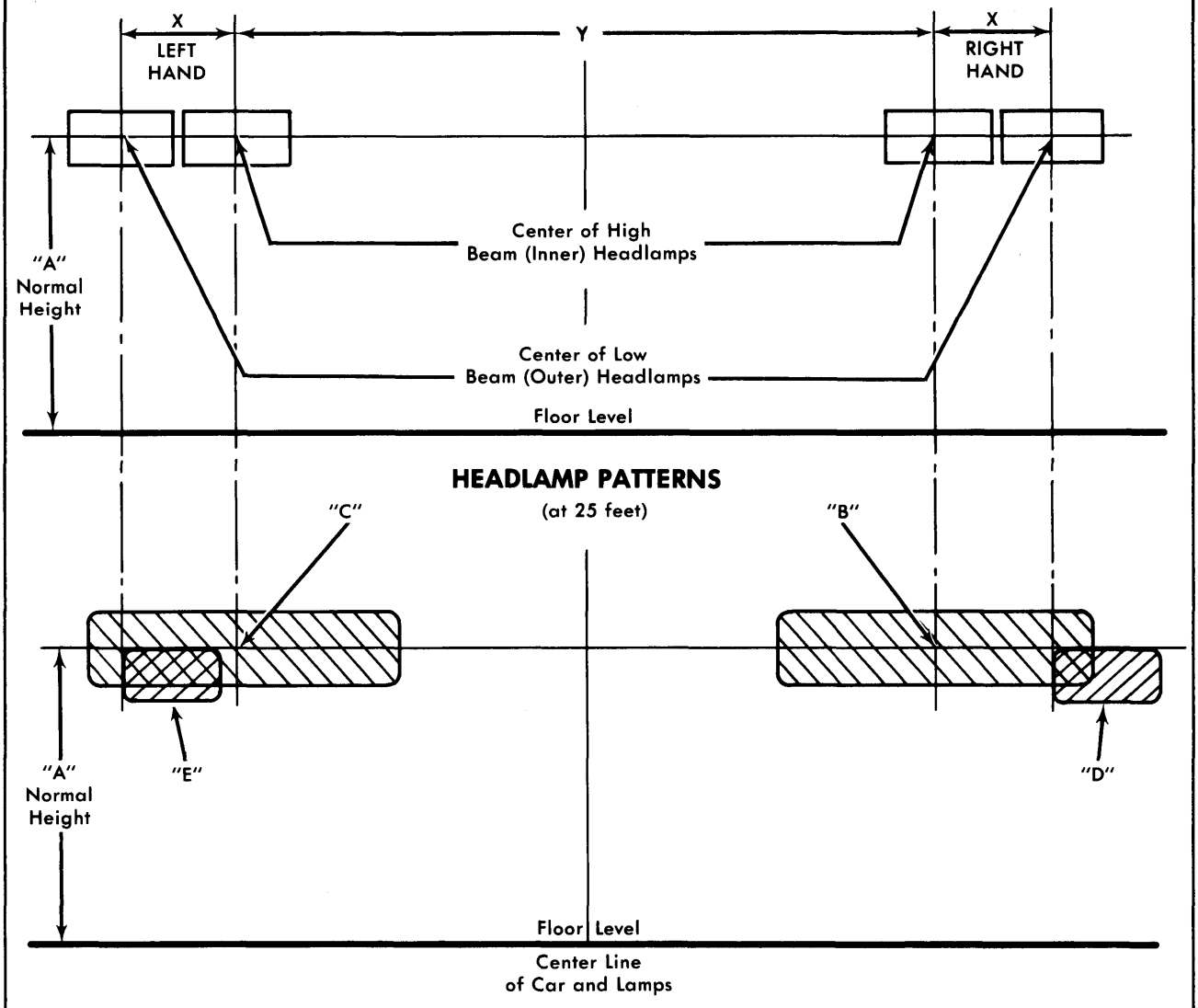
1. Connector electrical and lamp monitor connectors.

(NOTE: The high beam headlamp fiber optic has a blue marking near the end. The low beam headlamp fiber optic has a similar marking which is white.)

BACK TO INDEX

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HEADLAMP LOCATIONS



Inner Lamps Are High Beam Only
Outer Lamps Are Both High And Low Beam, But Are Aimed On Low Beam Only

	EXCEPT ELDORADO		ELDORADO	
	INCHES	MILLIMETERS	INCHES	MILLIMETERS
X	7.26	184.5	6.90	175.0
Y	45.00	635.0	44.40	620.0

Fig. 12-6 Headlamp Locations and Patterns

BACK TO INDEX

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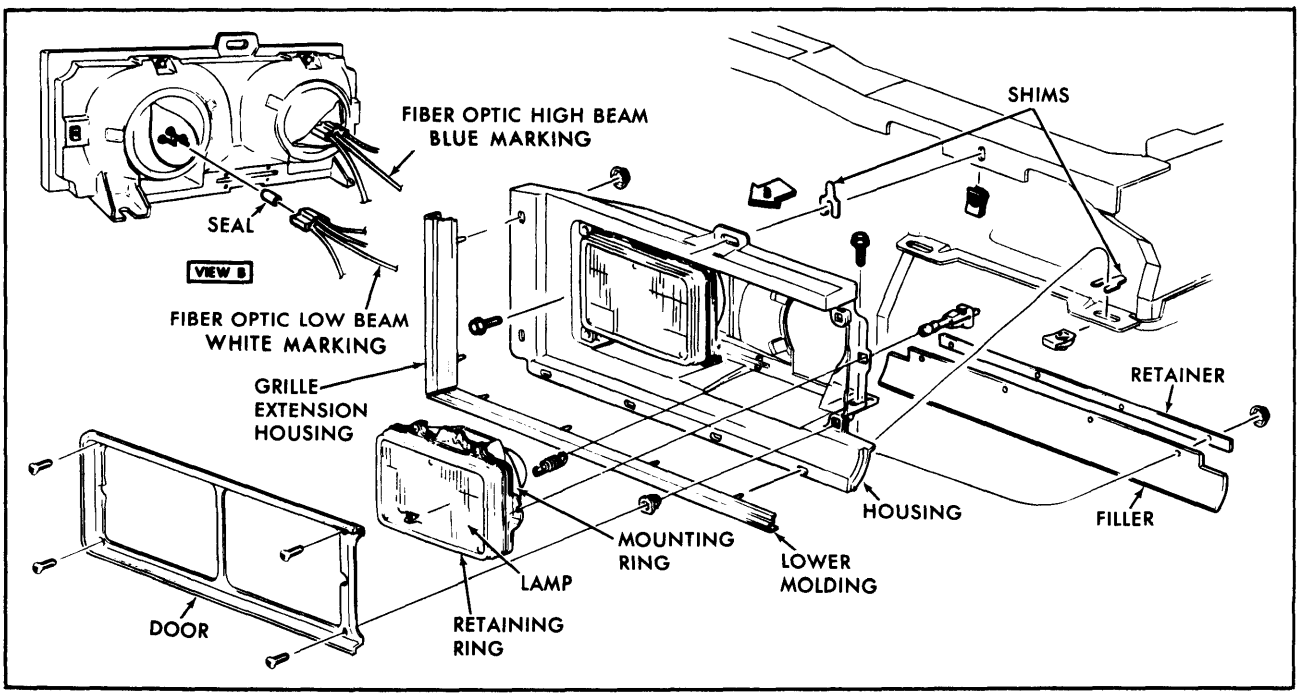


Fig. 12-7 Headlamp and Housing (Except Eldorado)

2. Position lower shims and gently position headlamp housing making certain washers on retaining screws are on top of housing attaching tabs.
3. Install upper retaining screw and install shims in same position as when they were removed.
4. Using a twelve inch socket extension and working through holes in radiator cradle, tighten 2 lower retaining screws to 60 inch pounds.
5. Connect negative battery cable and tighten to 70 inch pounds.
6. Check operation of lamps and lamp monitors.
7. Aim headlamps as described in Note 1 or 2.

5. Headlamp Housing Trim Moldings (Exc. Eldorado) (Fig. 12-7) Horizontal

a. Removal

1. Open hood, reach behind radiator grille and remove inboard nut securing horizontal molding to headlamp housing.
2. Reach under bumper and remove remaining three nuts securing molding to headlamp housing and remove molding, filler and retainer.

b. Installation

1. Position and align molding, filler and retainer. Reach under bumper and secure molding with 3 outer nuts.
2. Reach behind grille and install inboard nut. Close hood.

Vertical Grille Extension (Except Eldorado) (Fig. 12-7)

a. Removal

1. Open hood, reach behind radiator grille and remove 2 nuts securing vertical molding to headlamp housing.

b. Installation

1. Position and align vertical molding. Reach behind grille and secure molding with 2 nuts.

6. Front Parking Signal, Cornering, Side Marker Lamp and Bezel Assembly (Exc. Eldorado) (Fig. 12-8)

(NOTE: The lens is permanently assembled to the housing and is not serviceable separately.)

a. Removal

1. Disconnect two bulb and socket assemblies and fiber optic from back side of lamp and bezel assembly.
2. Remove 5 screws which attach lamp assembly to fender.
3. To remove lamp unit or chrome ornament from bezel, remove 4 screws from back of assembly.
4. To remove insert from bezel, remove 2 nuts from back of bezel.

BACK TO INDEX

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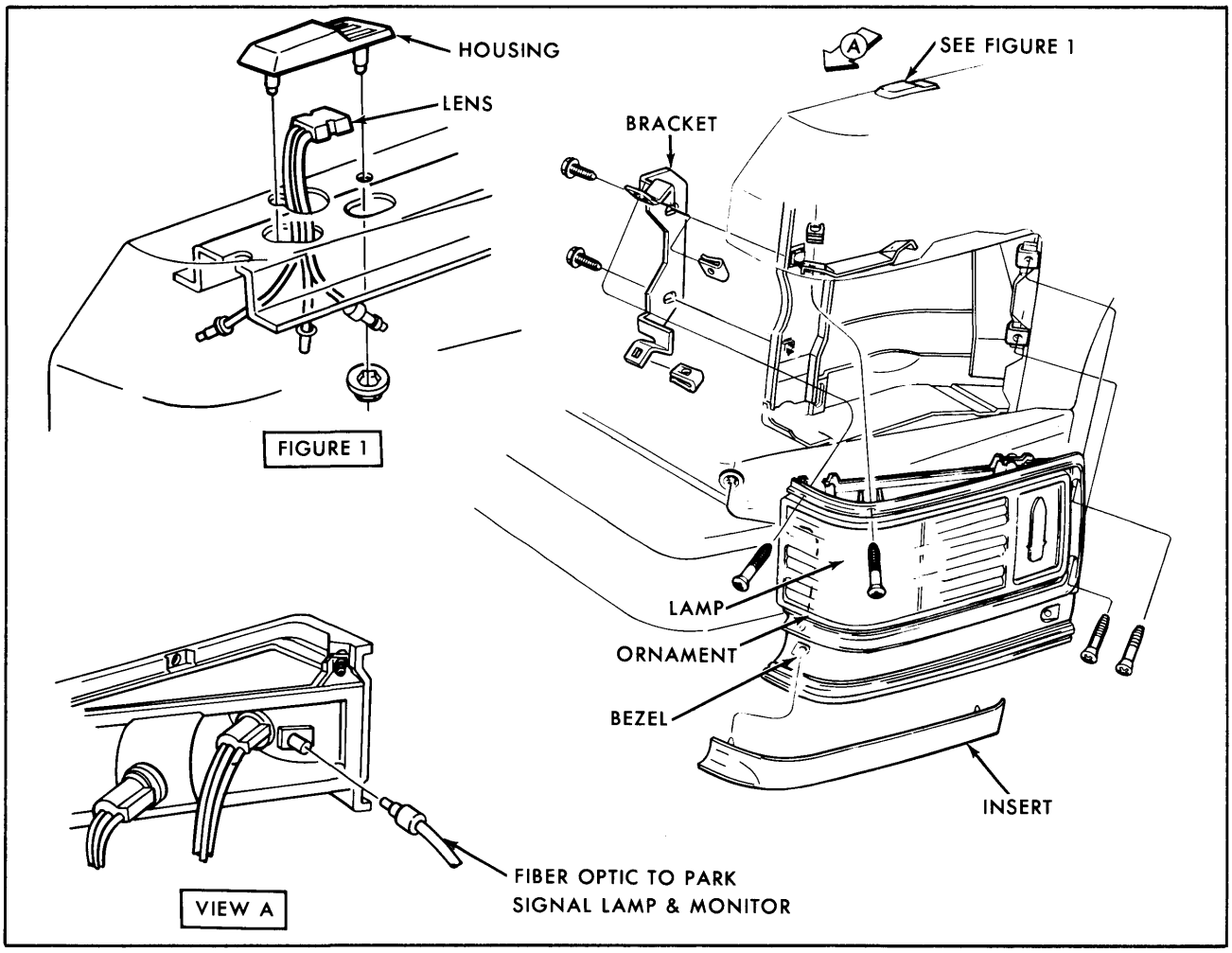


Fig. 12-8 Parking, Cornering and Directional Signal and Side Marker Lamp (Except Eldorado)

b. Installation

1. Attach insert to bezel with 2 nuts.
2. Assemble chrome ornament to lamp unit, position both into bezel and secure with 4 screws.
3. Position lamp and bezel assembly onto fender and secure with 5 screws.
4. Connect parking and directional signal lamp and socket into front lamp pocket. Connect cornering lamp and socket into rear lamp pocket. Connect fiber optic into pocket next to parking and directional signal lamp.

7. Tail, Stop-Signal Lamps, Back-Up Lamp Assembly (Exc. Eldorado) (Fig. 12-9)

a. Removal

1. Open trunk, remove 4 screws securing bezel to lamp housing and remove bezel.
2. Remove two screws securing lamp assembly to mounting brackets and pull assembly away from body.
3. Disconnect wiring connectors and lamp monitor fiber optic and remove lamp assembly from body.

b. Installation

1. Position lamp assembly near body and connect wiring and lamp monitor connectors.
2. Position lamp assembly on mounting brackets and secure with two screws.
3. Position bezel to lamp housing and secure with 4 screws.

8. Tail, Stop-Signal Lamp, Back-Up Lamp Assembly (Commercial Chassis Only)

a. Removal

1. Working from bottom of rear bumper, remove 2 screws securing lamp assembly to bumper center bar.
2. Disengage lamp assembly from bumper and disconnect stop-signal and back-up connectors.
3. Remove 4 screws securing lamp assembly to bracket and separate parts.

b. Installation

1. Position lamp assembly to bezel and to bracket.

BACK TO INDEX

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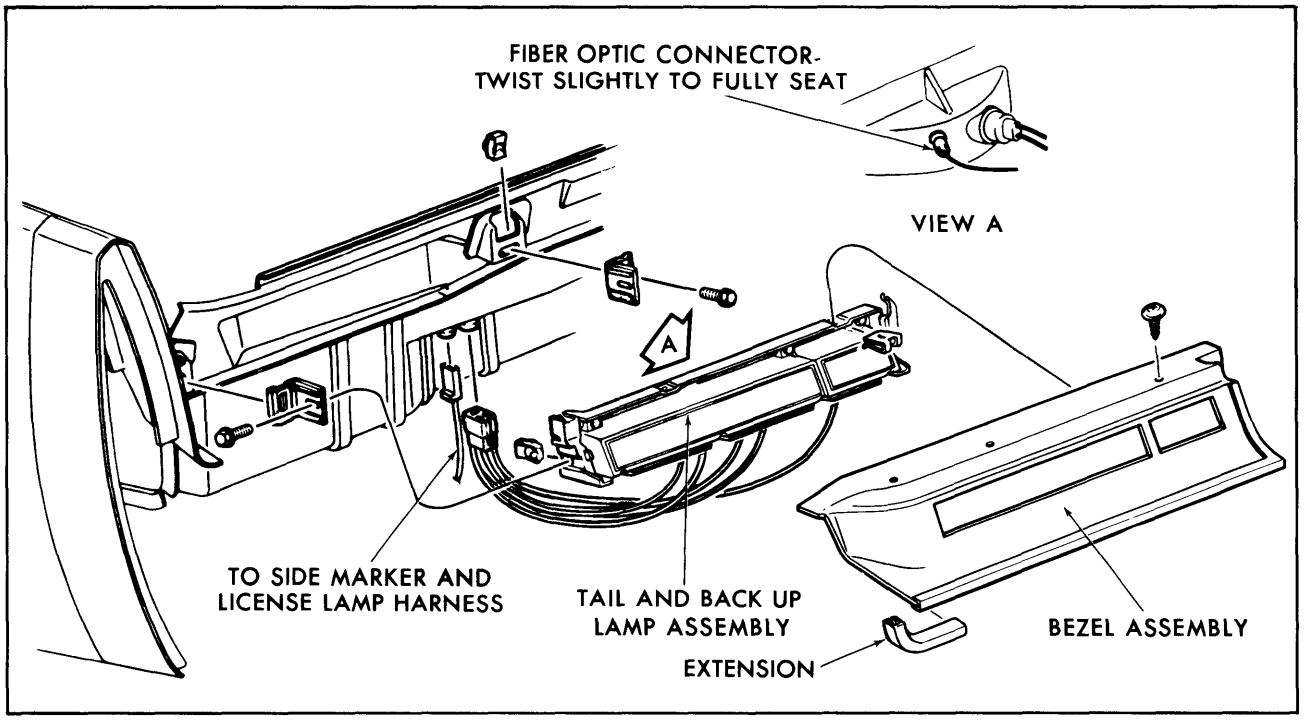


Fig. 12-9 Tail, Stop and Back-Up Lamp (Except Eldorado)

Secure with 4 screws. Washer is installed between lamp assembly and bracket of lower inner mounting screw.

2. Position lamp under bumper and install stop signal and back up connectors.

3. Position lamp assembly to bumper and secure with 2 screws.

9. Rear Side Marker Lamps (Exc. Eldorado) (Fig. 12-10)

a. Removal

1. Remove screw securing side markers to bumper outer end.

2. Pull lamp up and out of retaining clip at each side of bumper and disconnect bulbs and sockets.

b. Installation

1. Install bulb and socket into outer lamp assembly.

2. Install outer lamp assembly to bumper with bottom of lamp engaged in retaining clip.

3. Repeat steps 1 and 2 for inner lamp.

4. Secure lamps to bumper with one screw.

10. License Plate Lamp (Fig. 12-10)

a. Removal

1. Open fuel filler door and remove two screws securing license plate filler to bumper.

2. Remove one screw securing lamp assembly to bumper and remove lamp.

3. Disconnect light bulb by twisting socket.

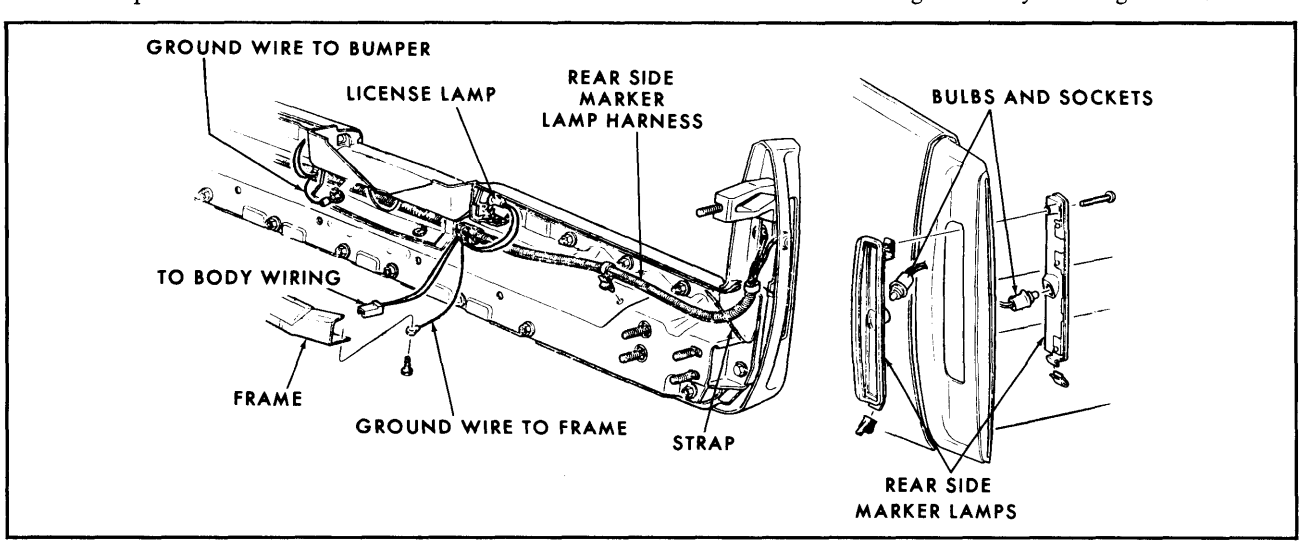


Fig. 12-10 Rear Side Marker and License Lamps (Except Eldorado)

BACK TO INDEX

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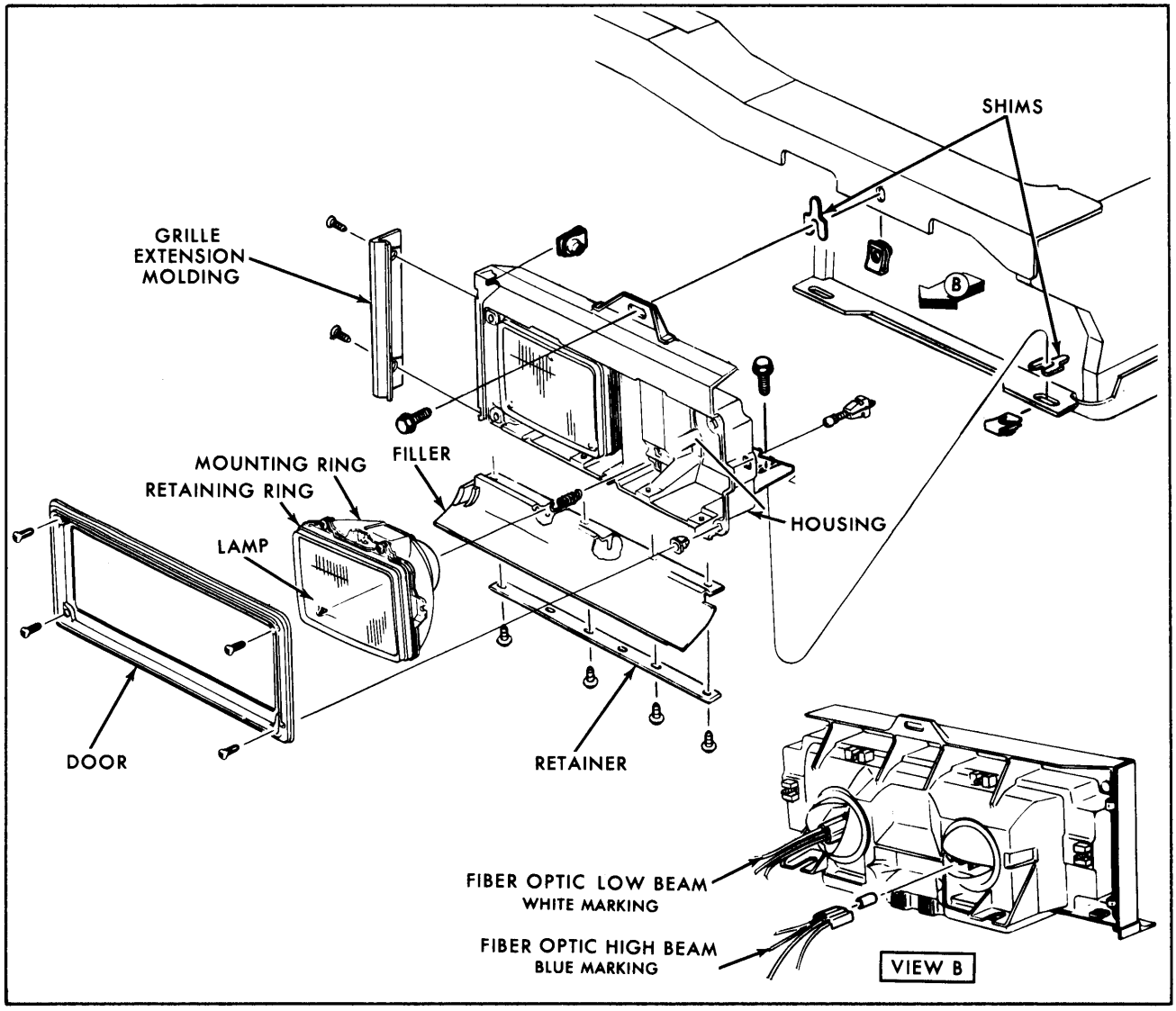


Fig. 12-11 Headlamp and Housing—Eldorado

b. Installation

1. Position lamp housing behind bumper and install light bulb socket.
2. Position lamp assembly to bumper and secure with one screw, working through license filler area.
3. Position license filler and secure with two screws.

11. Headlamp Replacement (Eldorado) (Fig. 12-11)

a. Removal

1. Remove 4 screws servicing headlamp bezel to headlamp housing.
2. Remove 4 screws securing headlamp retaining ring to mounting ring.
3. Disconnect electrical and lamp monitor connector.
4. Remove lamp monitor seal from headlamp and remove headlamp.

b. Installation

1. Install lamp monitor seal onto headlamp.
2. Connect electrical connector and position headlamp into mounting ring.
3. Install headlamp retaining ring and secure with 4 screws.
4. Position headlamp bezel and secure with 4 screws.
5. Check operation of headlamps and lamp monitors.
6. Aim headlamps as described in Note 1 or 2.

12. Headlamp Housing Grille Extension Molding (Eldorado) (Fig. 12-11)

a. Removal

1. Open hood.
2. Reach behind radiator grille and remove 2 screws from grille edge of grille extension molding.

BACK TO INDEX

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b. Installation

1. Position and align molding onto headlamp housing.
2. Reach behind radiator grille and secure molding with 2 screws.

13. Side Marker and Cornering Lamp Assembly and Bezel (Eldorado) (Fig. 12-12)

a. Removal

1. Remove 3 screws securing lamp assembly to fender.
2. Remove lamp assembly and disconnect electrical and lamp monitor connectors.
3. Remove 4 screws securing bezel to lamp assembly.

b. Installation

1. Install bezel to lamp assembly and secure with 4 screws.
2. Connect electrical & lamp monitor connectors.
3. Position lamp assembly into fender and secure with 3 screws.

14. Parking Lamp Assembly (Eldorado) (Fig. 12-12)

a. Removal

1. Disconnect negative battery cable.
2. Reaching behind bumper remove 2 screws which secure parking lamp to bumper.
3. Disconnect electrical and lamp monitor connectors and remove lamp through front of bumper.

b. Installation

1. Install electrical and lamp monitor connectors.
2. Position parking lamp into bumper from front side of bumper. Working from behind bumper secure parking lamp with 2 screws.
3. Connect negative battery cable and tighten to 70 inch pounds.

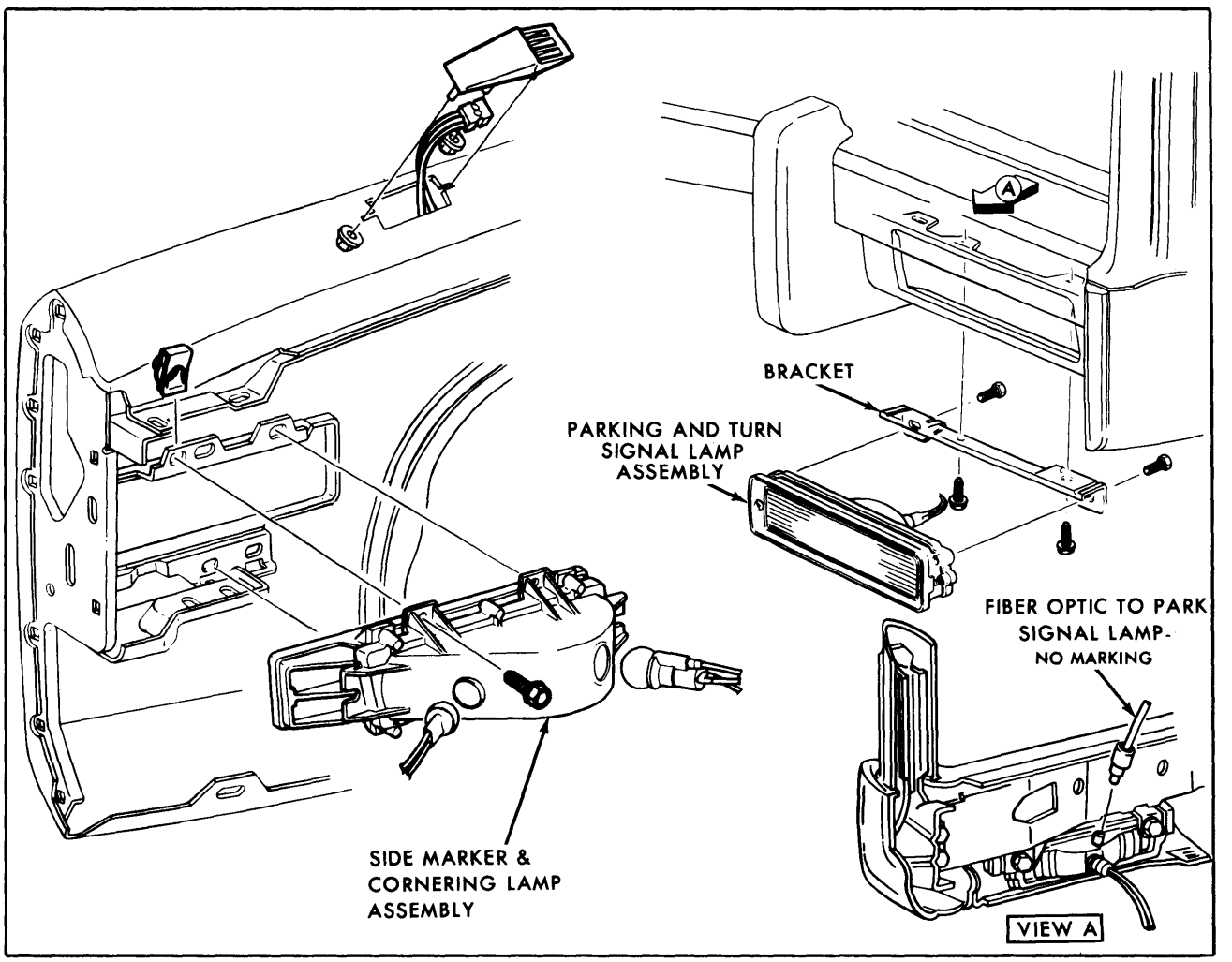


Fig. 12-12 Parking, Cornering, Directional Signal and Side Marker Lamps—Eldorado

BACK TO INDEX

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15. Front Parking Lamp Lens, Bezel and Gasket Replacement (Eldorado) (Fig. 12-12)

a. Removal

1. Remove 2 screws securing parking lamp bezel to lamp.
2. Remove bezel, lens and gasket from lamp.
3. Remove bulb from socket.

b. Installation

1. Install bulb into socket.
2. Position gasket onto lens and install onto lamp.
3. Install bezel and secure with 2 screws.

16. Tail, Stop and Turn Signal Lamps (Eldorado) (Fig. 12-13)

a. Removal

1. Remove 2 screws securing escutcheon to tail lamp assembly.
2. Open trunk and remove 5 screws securing bezel to body.
3. Remove 2 screws securing lamp to mounting bracket.
4. Disconnect bulbs and sockets and lamp monitor fiber optic from lamp.
5. Remove lamp assembly.

b. Installation

1. Connect bulb and sockets and lamp monitor fiber optics to lamp assembly.
2. Position lamp assembly to mounting bracket and install 2 screws.
3. Position bezel over lamp assembly and install 5 screws securing bezel to body.
4. Position escutcheon onto lamp assembly and secure with 2 screws.
5. Check fit of bezel to bumper and adjust tail lamp assembly fore and aft for best fit.

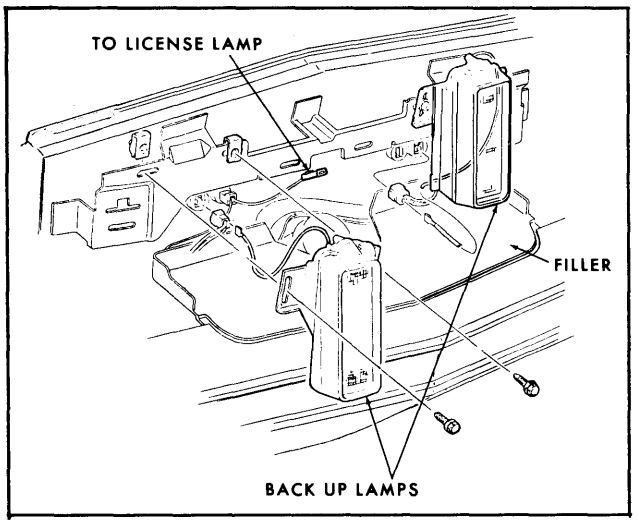


Fig. 12-14 Back-Up Lamps—Eldorado

17. Back-Up Lamp Assembly (Eldorado) (Fig. 12-14)

a. Removal

1. Turn ignition off.

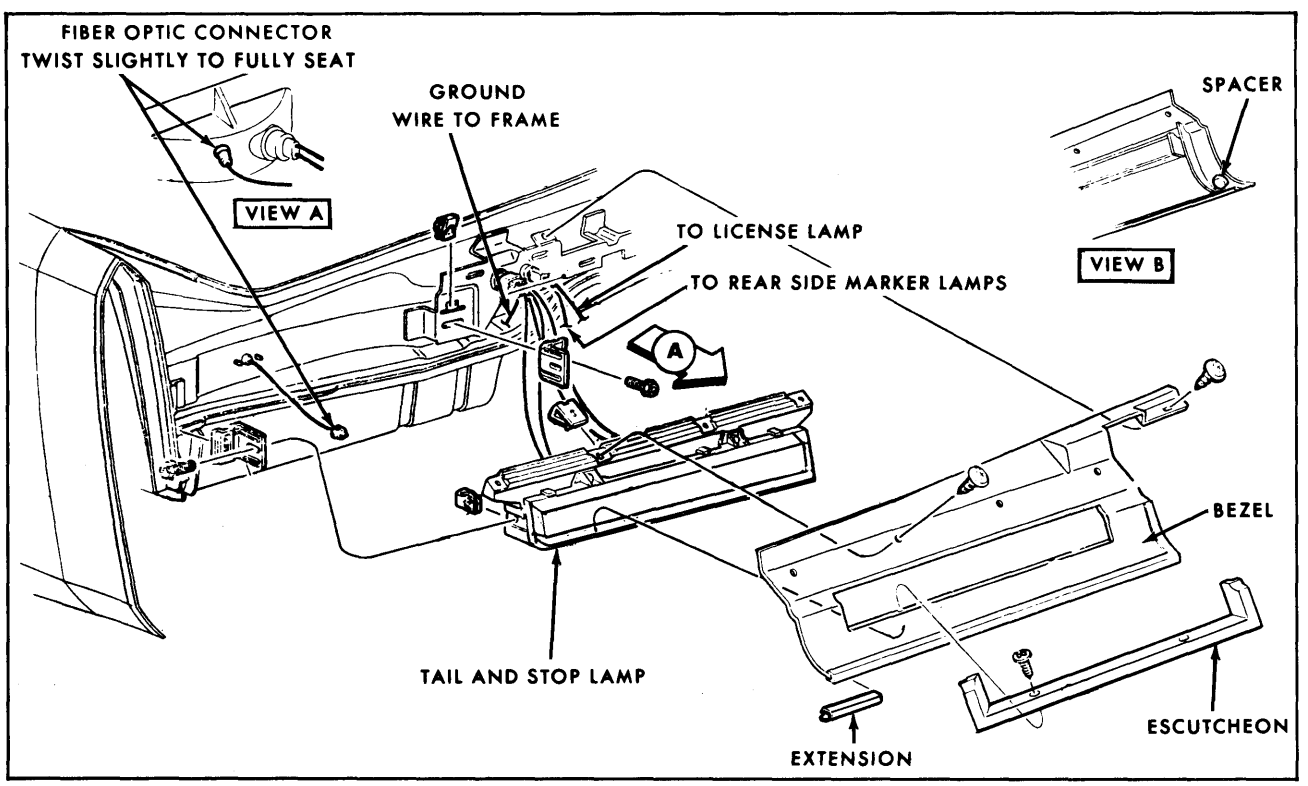


Fig. 12-13 Tail and Stop Lamps—Eldorado

BACK TO INDEX

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2. Remove four screws securing filler panel to body and remove panel.
3. Remove two screws and star washers securing back-up lamp housing to body bracket and separate housing from bracket. Inboard screw is made accessible by opening fuel filler door.
4. Disconnect wiring harness at connector behind license plate and remove back-up lamp assembly.

b. Installation

1. Open fuel filler door, make sure U-nuts are in place, position lamp assembly on bracket, and secure with two screws and washers, tightening to 60 inch-pounds.

(NOTE: Make sure proper alignment is obtained. Vertical adjustment is achieved through slotted holes in housing, horizontal adjustment by slotted holes in body bracket.)

2. Connect wiring behind license plate.
3. Secure trim panel with four screws.

18. Rear License Plate Lamp Assembly (Eldorado) (Fig. 12-15)

a. Removal

1. Remove two screws and star washers securing lamp housing to fuel filler door bracket.
2. Pull lamp housing down to gain access to connector.
3. Remove bulb socket from housing by turning counterclockwise.
4. Remove bulb from socket.

b. Installation

1. Install bulb in socket.
2. Install socket in housing by inserting and turning clockwise.
3. Position housing on fuel filler door bracket and secure with two screws and star washers. Secure ground strap under left U-nut.

19. Bulb Replacement (Except Eldorado)

It is necessary to carefully check the parts catalog for correct model application when replacing lamp socket assemblies. If incorrect sockets are used for replacement, the bulb filament will be in the wrong location with respect to the lens and/or reflector. As a result, the lamp may fail to meet the required lighting standards.

A complete list of replacement bulbs is given in the bulb chart on the following page. The procedures for making replacements are outlined in this note except those that are exclusive to Eldorados, which are described in Note 20.

CAUTION: Make certain ignition switch and headlight switch are off when replacing bulbs.

a. Front Park - Signal Lamp, Cornering Lamp, Side Marker Lamp

Access to the bulbs is gained by opening the hood and removing the bulb and socket from the back side of the particular lamp assembly.

b. Rear Tail and Stop-Signal Lamp

Access to these bulbs is gained by removing the bezel (three screws) and removing the lens. Commerical chassis bulb is accessible from under rear bumper.

c. Back-Up Lamp

Gain access to back-up lamp by removing appropriate filler panel (three screws) and removing the lens. Commercial chassis bulb is serviced from under rear bumper.

d. Rear Side Marker and Reflex

Remove lamp assembly (one screw) and move away from bumper.

e. License Plate Lamp

Access is gained by removing appropriate side filler panel (three screws).

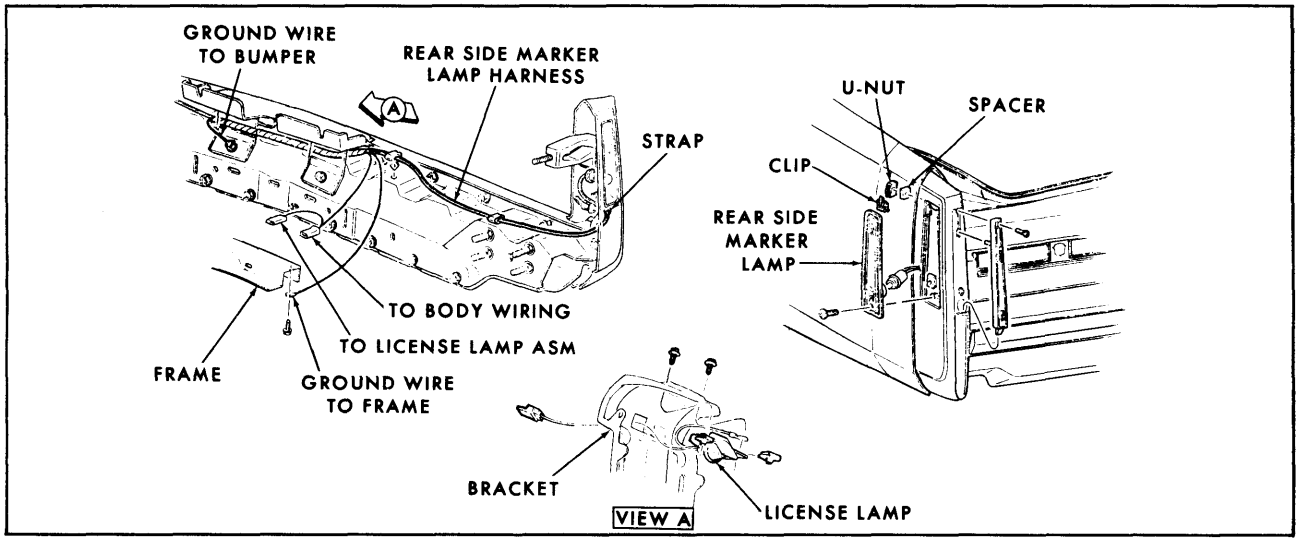


Fig. 12-15 Rear Side Marker and License Lamp—Eldorado

BACK TO INDEX

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BULB DATA CHART

FUNCTION	BULB NUMBER	CANDLEPOWER
Accessory Switch Illumination	1445	.7
Air Cushion Telltale Lamp	194	2
Ash Tray Lamp	1445	.7
Ash Tray Lamp - R.H. Front Door	1445	.7
Back-Up Lamp	1156	32
Clock	1895	2
Cornering Lamp-(exc. Eldorado)	1156	32
Cornering Lamp-(Eldorado)	1295	50
Courtesy Lamp-Instrument Panel	906	6
Courtesy Lamp-Front Door, Rear Door Rear Quarter Armrest	212/212-1/212-2	6
Courtesy Lamp-Sail Panel	90	6
Cruise Control-Switch Illumination	53	1
Cruise Control-Indicators (Green and Amber)	1445	.7
Door Lock Illumination	558	2.5
Fuel Gage	194	2
Fuel Economy Telltale Lamps	161	1
Generator Telltale Lamp	194	2
Glove Compartment Lamp	1816	3
Headlamp-Inner	4651	50 Watts
Headlamp-Outer	4652	40 W/60W
Headlamp Switch Lamp	1816	3
Climate Control Lamp	1816	3
High Beam Indicator	194	2
Instrument Cluster Illumination	194	2
License Lamp (exc. Commercial Chassis)	194	2
License Lamp–Commercial Chassis	67	4
Low Brake Telltale Lamp	194	2
Low Oil Pressure Telltale Lamp	194	2
Low Washer Fluid Telltale	161	1
Map Lamp	562	6
Marker Lamp-Front Side	194A	2
Marker Lamp-Rear Side (Eldorado)	168	3
Marker Lamp-Rear Side (exc. Eldorado)	194	2
Opera Lamp	756	.3
Park-Signal Lamp (exc. Eldorado)	1157NA	24/2.2
Park-Signal Lamp (Eldorado)	1157	32/3
Radio Dial Lamp (exc. Tape Player)	1895	2
Radio Dial Lamp (with Tape Player)	563	4
Radio AM-FM Band, Stereo or Tape Indicators	*Special #66	–
Radio-Rear Control Indicator	250	1
Rear Window Defogger Indicator Lamp	1445	.7
Seat Belt Telltale	194	2
Security System Telltale	194	2
Shift Indicator Illumination	161	1
Spot Lamp-Front Compartment	90	6
Spot Lamp-Reading	1004	15
"Stop Engine Temp" Warning Light	194	2
Stop, Tail, and Signal	1157	32/3
L.H. Storage Compartment–ACRS	1445	.7
Trunk Compartment Lamp	1003	15
Trunk Lid Telltale	161	1
Turn Signal Cluster Indicators	194	2
Warning Lamp - Doors (Combined with Courtesy Light)	212/212-1/212-2	6
Water Temperature Telltale	194	2
Windshield Wiper Switch Illumination	194	2
Vanity Mirror	562	6

*Serviceable only by Radio Technician.

BACK TO INDEX

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f. Cruise Control Switch Lamp and Headlight Switch Lamps

Remove lower steering column cover as described in Note 58a for access to these bulbs. Remove climate control panel as described in Note 69a for access to upper headlight switch lamp.

g. Windshield Wiper Switch Lamp

Remove switch as described in Note 74a for access to this bulb.

h. Radio Dial Lamp

Dial lamp is replaced by removing the instrument panel pad on all radios except AM/FM stereo tape radio.

Access to the stereo AM/FM tape radio dial lamp is through the tape access door.

i. Clock Lamp, Warning Lamps

Remove instrument panel pad as described in Note 59 for access to these lamps.

j. Fuel Gage Lamp

Remove instrument panel pad (Note 59a) and L.H. A/C Hose Adapter.

k. Speedometer Cluster Lamps

Remove speedometer cluster as described in Note 62a for access to all lamps in the cluster.

l. Accessory Switch Lamps

Remove right Insert and Applique as described in Note 78a for access to bulbs.

20. Bulb Replacement (Eldorado)

a. Side Marker

Access to the side marker bulb is gained by opening the hood and removing the front bulb and socket by turning it counterclockwise.

b. Cornering Lamp

Access to the cornering lamp bulb is gained by opening the hood and removing the rear bulb and socket by turning it counterclockwise.

c. Parking and Directional Signal

Remove lens and bezel as described in Note 15.

d. Back-Up Lamp

Remove lens (two screws) for access to bulb.

BACK TO INDEX

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WIRING AND CIRCUIT PROTECTION

GENERAL DESCRIPTION

Wiring

Chassis wiring utilizes two twenty-eight pin bulkhead connectors. One is located on the back of the fuse panel the second behind the heater case. Separate wiring grommets in the cowl are used for trackmaster, guide-matic and/or electronic fuel injection harnesses.

Solid core aluminum wire is used in the forward body harness. The aluminum wiring is encased in brown conduit (copper is in black conduit). A special service procedure and repair kit is required for aluminum wire splices. The repair procedure is described in Note 21 of this section.

The pack-con positive retention type wiring connector is used extensively throughout most wiring circuits. This type connector requires that the connector retaining lock be released before the two halves of the connector can be separated.

Body and accessory wiring circuit diagrams are located at the end of this section. Optional equipment wiring circuit diagrams are located in Section 15. A complete chassis circuit wiring diagram can be found on the rear gatefold.

Circuit Protection

All electrical circuits are protected against excessive loads which might occur due to shorts or overloads in the wiring system. Such protection is provided by either a fuse, circuit breaker, or fusible link. Each of these protective devices is explained as follows:

Fuses

The most common method of automotive wiring circuit protection is the fuse. Whenever there is an excessive amount of current flowing through a circuit the fusible element will melt and create an open or incomplete circuit. Fuses are a one time protection device and must be replaced each time the circuit is overloaded.

The fuse panel (Fig. 12-16) or "Fuse Block" contains most fuses which protect the various circuits. There are, however, additional specific circuits. In-line fuses are located on a wire within an individual wiring harness. They are usually housed in spring loaded, twist type receptacles.

Fuse panel fuse locations, amperage capacity and the circuits which they protect are listed in Fig. 12-16. Fuses are color striped according to the code listed in the following chart.

Fuse	Color Stripe
3	Violet
5	Tan
7.5	Brown
10	Red
15	Light Blue
20	Clear
25	White

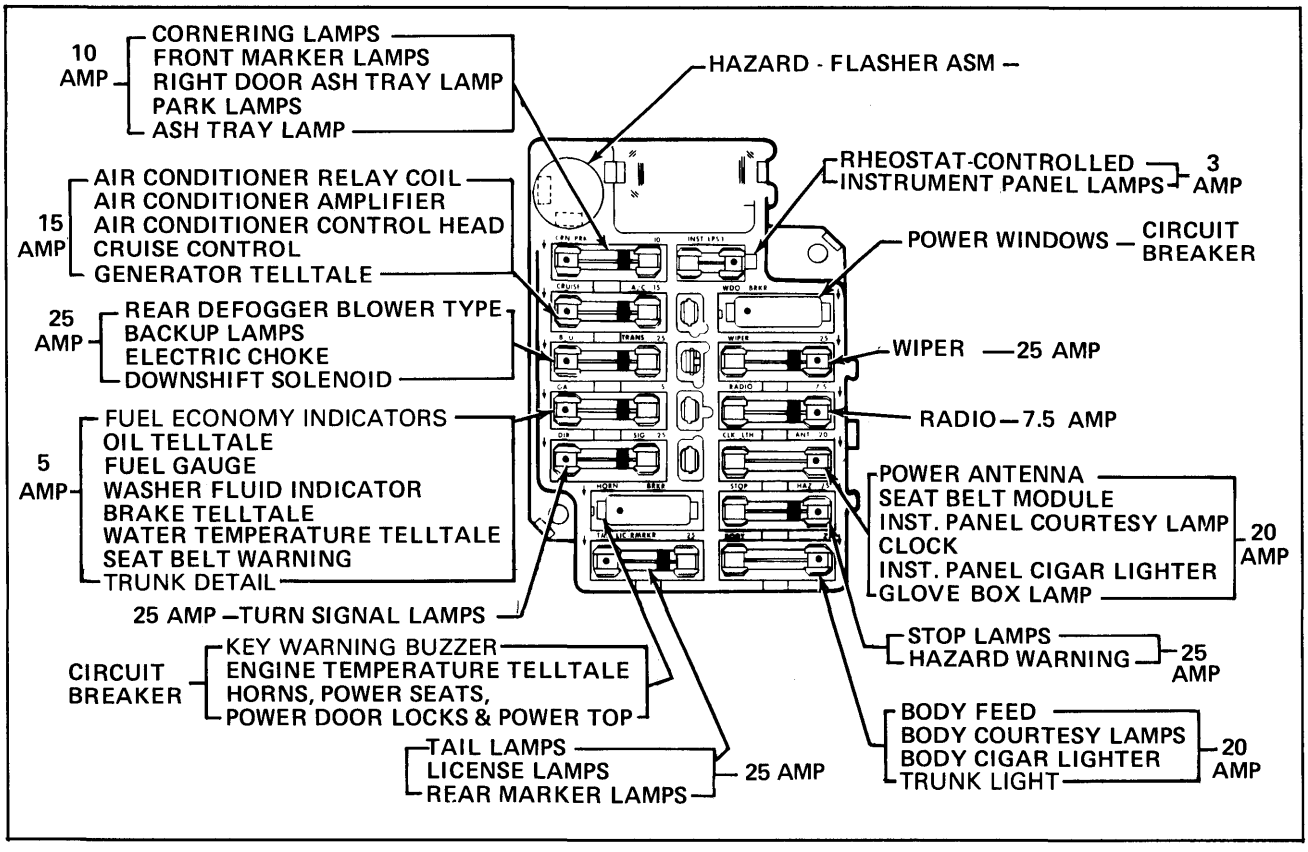


Fig. 12-16 Fuses and Fuse Block

BACK TO INDEX

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Factory installed unstriped fuses are 20 amp. For service replacement common unstriped fuses of the same respective amperage may be used. The amperage value on an unstriped replacement fuse is listed on the metal end cap. Fuses should be replaced with one of exactly the same amperage as listed in Fig. 12-16.

Circuit Breakers

A circuit breaker is a protective device designed to open the circuit when a current load is in excess of rated breaker capacity. If there is a short or other type of overload condition in the circuit, the excess current will open the circuit breaker terminals, thus, indicating there is something wrong in the system. The circuit breaker will remain open until the trouble is found and corrected. Circuit breaker locations, circuit protected and capacity are listed in the chart on Page 12-26 and in the fuse panel illustration, Fig. 12-16.

Fusible Links

In addition to circuit breakers and fuses, a few circuits incorporate fusible links to protect the wiring. Links are used rather than a fuse in wiring circuits that are not normally fused, such as the ignition circuit. Each fusible link is at least four gauge sizes smaller than the cable it is designed to protect. Links are marked on the insulation with wire gauge size because the heavy insulation makes the link appear to be a heavier gauge than it actually is. The same size wire with special hypalon insulation must be used when replacing a fusible link. Fusible link location is listed in the chart on Page 12-26.

The appearance of a fusible link before and after a short circuit is shown in Fig. 12-17.

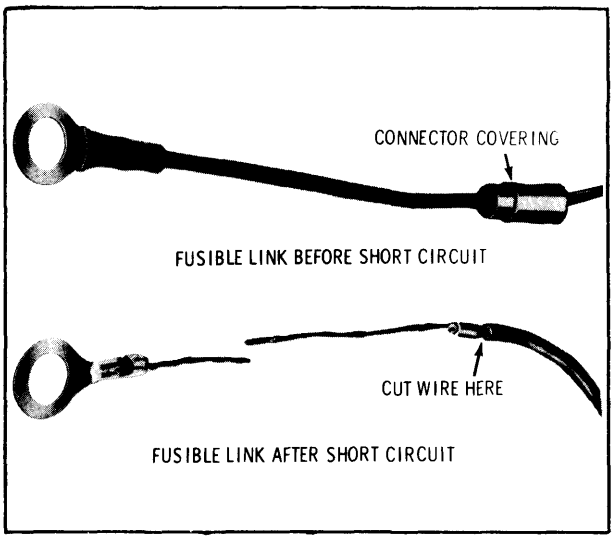


Fig. 12-17 Fusible Link Identification

DIAGNOSIS

Malfunctions in a circuit are usually caused by shorted or open circuits. Open circuits are usually caused by breaks in the wiring, improper connections or a mechanical problem in a component such as a switch or circuit breaker. Short circuits are usually caused by wires from different components of the circuit contacting one another or by a wire or component grounding to the metal of the body due to a screw driven through the wires, insulation cut through by a sharp metal edge, etc.

The following information may aid in locating and correcting a malfunction in the body wiring electrical system.

1. If a major portion of the electrical circuit becomes inoperative simultaneously, the problem may be due to improper connections between the front and rear harness or between a forward harness and the bulkhead connector on the back of the fuse block.

2. If only one of the circuits is inoperative, the problem is due to an open circuit or short in the affected circuit. Short circuits usually result in blown fuses or in the case of power equipment circuits, in the circuit breaker opening the circuit. If the fuse is not blown and the circuit affected is a lamp circuit, check the bulb before proceeding with any checking procedures.

3. The dome lamp, courtesy lamp and park brake warning lamp circuits are designed so that the switches are in the "ground" side of the circuit. If a condition is encountered where the lamps remain "on" even though the jamb or courtesy lamp switches are not actuated, the problem is probably due to malfunctioning switches, or to the wire leading to the switches being grounded to the metal body.

SERVICE OPERATIONS

21. Splicing Procedure for Aluminum Solid Core Wires

1. Using proper gage wire striper tool, strip a quarter inch of insulation from the ends of the wires to be spliced. Use caution to avoid damaging the core to prevent weakening the completed assembly.

2. Place one wire into special splice clip. Using ten-inch locking-type pliers or equivalent tool, Fig. 12-18, clip firmly to the wire. *Do not solder.*

3. Repeat Step 2 for Second wire.

4. After completing splice, apply a generous coating of petrolatum (petroleum jelly) over the clip and over approximately the first quarter inch of insulation on each side of clip.

(NOTE: Petrolatum is helpful in reducing wire oxidation.)

5. Wrap splice and area covered with petrolatum with electrical tape, Fig. 12-19.

BACK TO INDEX

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FUSES, RELAYS, CIRCUIT BREAKERS, FLASHERS AND FUSIBLE LINKS

Circuit	Location	Device
Rear Window Defogger	On left hand side of lower steering column cover reinforcement	25 amp Circuit Breaker (or Relay)
Sunroof	L.H. Body Bracket – at left end of lower steering column cover reinforcement	25 amp Circuit Breaker
Twilight Sentinel	Integral with amplifier on lower steering column cover reinforcement	Circuit Breakers
Windshield Wiper	Integral with wiper motor	Circuit Breaker
Turn Signal Flasher	On left hand side of lower steering column cover reinforcement	#323 Flasher
Hazard Warning Flasher	Upper left corner of fuse block	#552 Flasher
EFI Fuel Pump	In-Line – left of fuel injection ECU-16 gage brown wire	10 amp fuse - use ONLY AGC-10 or 3AC-10. Others could damage ECU.
Vanity Mirror	Behind Mirror	2 amp fuse
A/C Compressor	On evaporator case	Thermal Limiter Fuse Compressor Diode (Limo. Only)
Theft Deterrent	In-line above radio-yellow wire - black/red stripe wire	20 amp fuse (lights) 25 amp fuse (horn)
Horn Actuating	Below and to right of fuse block	Relay with key buzzer
Illuminated Entry	Behind left front kick panel (shroud)	Relay-Time Delay
A/C Auto	On evaporator case-side	Relay
Rear Defogger	On left side of lower steering column cover reinforcement	Timer Relay
Guide-Matic	To left of fuse block	Relay
Antenna	On right hand side of toe pan under front edge of carpet – near A/C programmer	Relay
Seat Belt Warning	On L.H. body bracket behind left side of lower steering column cover	Timer Relay (4 to 8 seconds) with integral buzzer
Automatic Door Locks	On shroud above L.H. kick pad	Locking Relay
	Below body wiring cross car conduit	Logic Module
	Tapered to logic module	Unlocking Relays (2)
Theft Deterrent	Underside of A/C center outlet support	Controller
Track Master	Top of glove box liner	Controller

BACK TO INDEX

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FUSES, RELAYS, CIRCUIT BREAKERS, FLASHERS AND FUSIBLE LINKS (CONT'D.)

Circuit	Location	Device
Key Warning	In horn relay – below and to right of fuse block	Buzzer
Fuel Injection Electronic Control Unit	Dark Green 14 Gage wire on "Bat" terminal of generator	18 Gage Fusible Link (Dark Green)
Ignition	Red 10 gage wire at starter solenoid	16 Gage Fusible Link (Black)
Headlamps	Yellow 14 gage wire at starter	18 Gage Fusible Link (Dark Green)
Climate Control and Body Feed	Black/red stripe 10 gage wire at starter	16 Gage Fusible Link (Black)

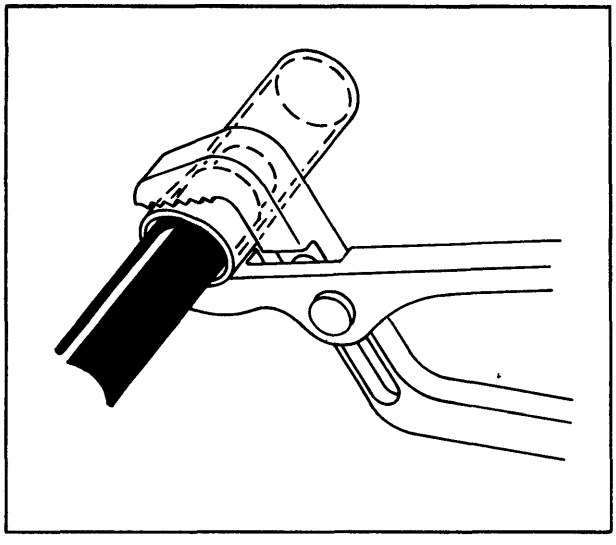


Fig. 12-18 Crimping Aluminum Wire Splice Clip

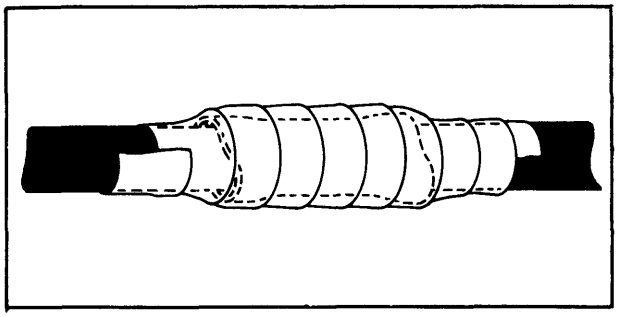


Fig. 12-19 Completed Aluminum Wire Splice

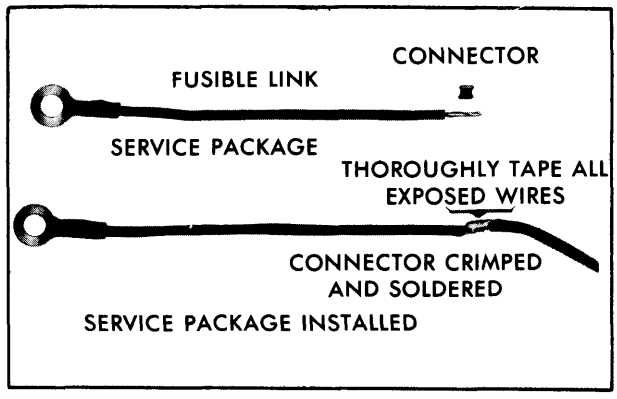


Fig. 12-20 Replacing Fusible Link

22. Fusible Link Replacement (Fig. 12-20)

A new fusible link can be installed, after the short circuit is located and repaired, as follows:

1. Disconnect battery ground cable.
2. Disconnect fusible link from starter or terminal.
3. Cut harness directly behind connector to remove damaged fusible link, Fig. 12-17.
4. Strip harness wire approximately 1/2".
5. Position clip around new fusible link and harness wire. Crimp so that all wires are securely fastened, Fig. 12-20.
6. Solder connection using rosin core solder. Use sufficient heat to obtain a good solder joint.
7. Tape all exposed wires with plastic electrical tape to prevent corrosion and shorting, Fig. 12-20.
8. Connect fusible link to starter or terminal.
9. Connect negative battery cable and tighten to 70 inch pounds torque.

BACK TO INDEX

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ELECTRICAL INSTRUMENTS

GENERAL DESCRIPTION

Ignition Switch

The starter switch is combined with the steering column and shift lever lock, located on the right side of the steering column below the lower steering column cover and is mechanically connected to the ignition switch located on the steering column jacket below the instrument panel. Fig. 12-21.

The engine is started by turning the key clockwise against spring tension to energize the starter solenoid. When the engine starts, releasing the key permits it to return to the Run position. All accessories (except Twilight Sentinel) are disconnected in the Start position.

The ignition lock has five key positions – Accessory – Lock – Off – Run – and Start. The Lock position is clearly marked on the left side of the lock cylinder and is coordinated with the pointer on the ignition knob. The transmission shift lever must be in Park position and the ignition knob in Lock position before the key can be inserted or removed. This locks the steering wheel and transmission shift lever as well as the ignition system.

The Off position allows the engine to be shut off without locking the steering wheel or transmission shift lever, so that the car can be steered or towed in case of any problem requiring turning off the ignition. The Run position completes the ignition circuit and activates all instruments and accessories.

The Accessory position allows the use of accessories with the ignition off.

The switch also features a buzzer system to warn the driver to remove the key from the lock. If the driver's door is opened with the key in the lock and the switch in the Off, Lock, or Accessory position, a relay buzzes and the Engine Temperature Warning light is illuminated as a reminder that the key has not been removed from the lock, Fig. 12-24.

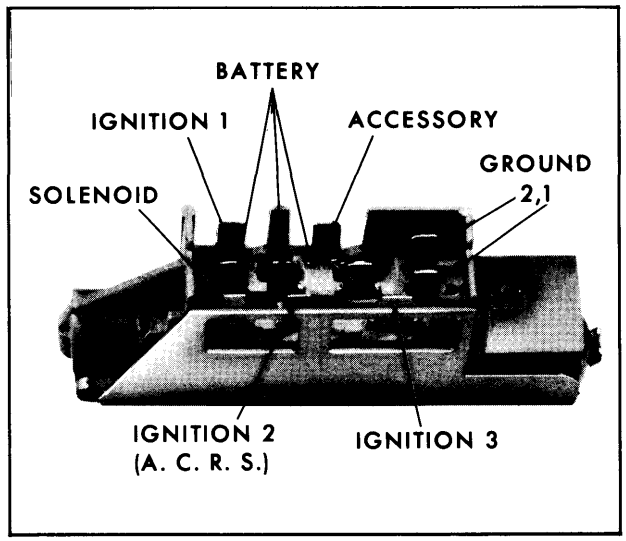


Fig. 12-21 Ignition Switch

Electrical Accessory Installation

When installing additional electrical equipment, such as Rear Window De-Fogger or Twilight Sentinel, connect this equipment to the proper terminals in the wiring harness or the accessory terminal on the fuse panel in accordance with the instructions provided with the accessory. Care should be exercised in installing accessories other than those that are Cadillac designed to avoid overloading the electrical circuits.

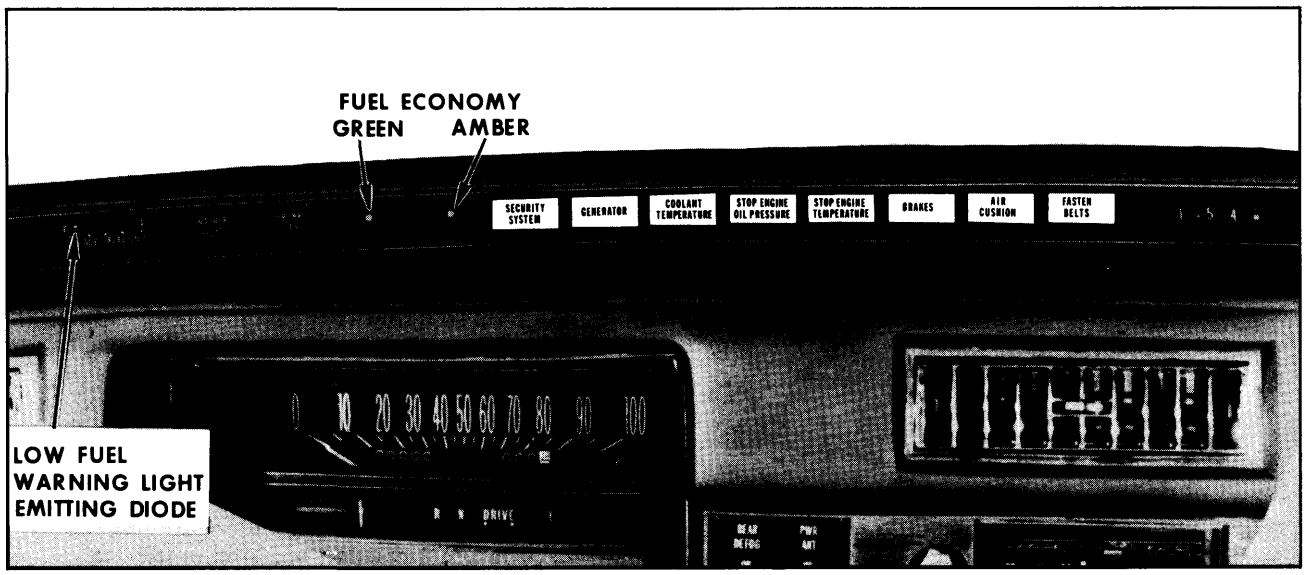


Fig. 12-22 Telltale Lamp Locations

BACK TO INDEX

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ELECTRICAL INSTRUMENTS

DIAGNOSIS

23. Fuel Gage (Fig. 12-22)

The fuel gage and bulb are fed through a separate connector on the rear of the gage rather than through the printed circuit. The connector is serviced after removing the instrument panel pad (Note 59) and positioning the L.H. A/C hose out of the way.

When checking the fuel gage circuit, first determine whether the tank unit, wiring, or fuel gage is problem area.

Although the following conditions may occur in a fuel indication system, they should not be considered as malfunction.

1. Pointer does not return to "E" when the ignition is turned off.
2. Pointer does not move below "F" after fill-up until considerable distance has been driven.
3. Gage does not always register full after fill-up. (This may result from fueling when the vehicle is not level or when the fuel is stopped by the first automatic shutoff of the pump nozzle. The last few gallons must be slowly hand-delivered to the tank.)
4. Tank is not empty when the pointer is on "E". (The tank contains approximately 1-1/2 gallons reserve by design when the gage reads empty.)

The following checks of the fuel indication system will determine quickly whether incorrect fuel gage readings are the result of an improperly operating fuel gage, fuel tank sending unit, or circuit wiring.

(NOTE: One important feature of the following procedures, is the absence of any checks that would place battery current in the system by use of "hot" jumper wires.)

a. Fuel Gage Diagnosis

1. Locate fuel tank sending unit connector (18-tan wire) in trunk at right side of lock mechanism and disconnect from license plate side. With a jumper wire, connect a known good float in body side of connector, grounding float unit to chassis. Slowly move float arm from full to empty position. If instrument panel gage follows float, proceed to step 4.
2. If gage on instrument panel does not follow, disconnect known good float and reconnect trunk connector. Inspect circuit wiring between instrument panel gage and trunk connector for damage. Check for electrical continuity at the tan wire in:
   a. Connector in left rear quarter trunk area.
   b. Body wiring connector to fuse block.
   c. Chassis harness connector to fuel gage.
3. If all connections are sound and no wire damage exists, replace the instrument panel fuel gage. Check system for proper operation after replacing gage.
4. If fuel gage operates correctly in step 1, problem is between trunk connector and tank sending unit ground. Examine trunk connector terminal and clean if required. Also inspect ground wire (18 black) for good connection on chassis; if loose or rusted, clean and reinstall.
5. If problem still exists, fuel tank sending unit must be inspected. Tank must now be lowered.
6. After lowering tank, check both feed wire (18 tan) and ground wire (18 black) for loose connections and continuity. If rusted, clean and reinstall; if open, repair.
7. Remove sending unit from tank, reconnect feed and ground wires to float unit. If fuel gage follows float arm movement, check baffle in gas tank for improper position, causing interference with float.
8. If fuel gage will not follow float arm movement, replace with new sending unit. Check new unit to see that fuel gage follows float arm movement; reinstall gas tank.

   a. If fuel gage remains pegged in full position, re-check for open in circuit wiring, such as disconnects, insulation in terminal crimps, rusted or loose connections, open wires, and terminals loosely seated or bypassed in connector.

   b. If fuel gage remains pegged in empty position, re-check for grounds in circuit wiring, including pinched wires, damaged wire insulation, and broken wires that touch chassis ground.

b. Bent Float Arm Check (Fig. 12-23)

1. Establish a fixed reference point when checking for a bent float arm by placing a straight edge on surface of cover plate, extending it outward.
2. With float in "Full" position against stop "D" distance from top of float (with float horizontal) to top of straight edge should be 2-15/16 inches ± 1/32 inch. With float arm in "Empty" position against stop "A",

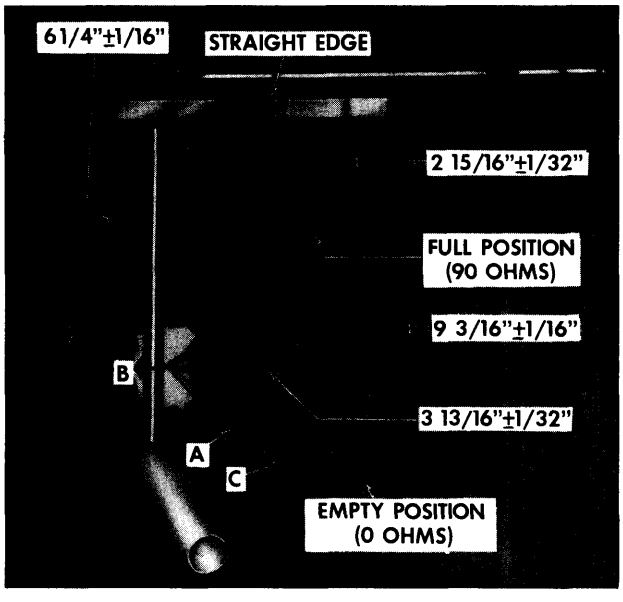


Fig. 12-23 Checking For Bent Float Arm

BACK TO INDEX

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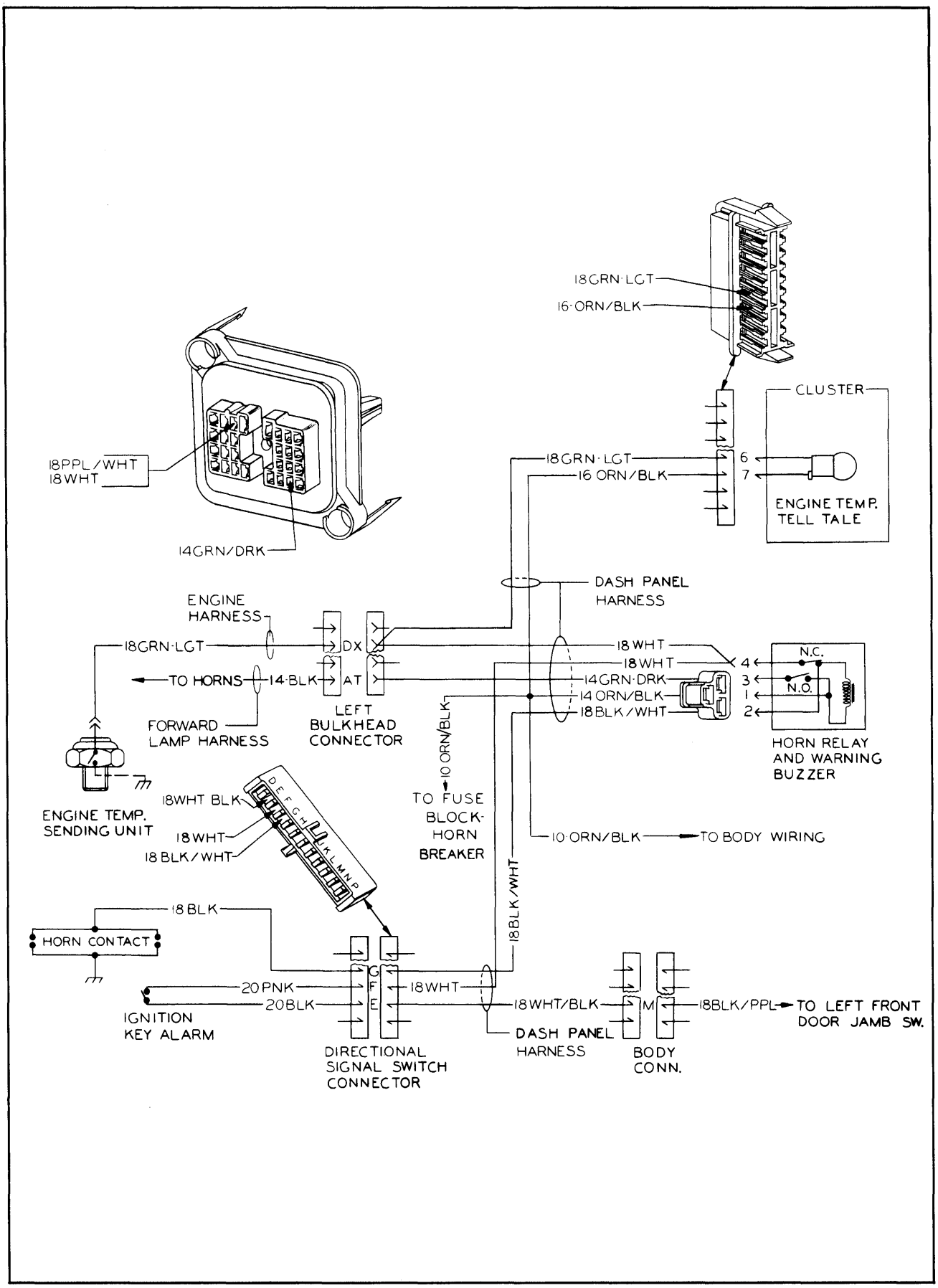


Fig. 12-24 Engine Metal Temperature Warning Circuit

BACK TO INDEX

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distance from bottom of float (with float horizontal) to top of straight edge should be 9-3/16 inches ± 1/32 inch. Bend float arm as needed. Check distance from point "B" to "C", which should be 3-13/16 inches ± 1/32 inch. Bend float arm as needed and recheck distance from bottom of float to straight edge.

TELLTALE LAMP DIAGNOSIS

Diagnosis of the generator lamp is found in Section 6, Note 35. Diagnosing the washer fluid lamp is discussed in Note 39. Theft deterrent lamp diagnosis is in Section 15. While all information on the Air Cushion Restraint system is contained in the ACRS service manual.

Proper operation of the remaining indicator lamp is described in the following notes. A malfunction in only one of the indicator lamps should be diagnosed as described in the appropriate note. More than one inoperative lamp may be caused by a blown fuse or a mispositioned printed circuit connector. These areas should be investigated prior to individual lamp diagnosis. Telltale indicator lamp locations are shown in Fig. 12-22.

24. High Beam Indicator Circuit

High beam indicator lamp should be ON whenever the high beam headlights are on.

1. Turn headlights ON. On cars equipped with Guide-Matic, rotate sensitivity control to OFF. Switch to high beam with dimmer switch.
2. If high beams come ON but indicator lamp does not glow, either bulb is burned out, connector is off at speedometer cluster printed circuit, 18 light green wire between left hand bulk head connector ("AU") and cluster connector is open or printed circuit is open.
3. If neither high beams nor indicator lamp come on, dimmer switch is malfunctioning or Guide-Matic is inoperative. Refer to Section 15 for Guide-Matic diagnosis.

25. Trunk Lid Warning Lamp ("Trunk Open")

The "trunk open" warning light should glow (amber) with the trunk lid open and the ignition switch in the "ON" position.

a. Trunk Lid Open - Lamp Off

1. Remove cover panel from lock mechanism in trunk compartment.
2. Remove 18 dark green wire from behind lock mechanism and ground wire using a jumper wire (ignition switch on).
3. If lamp comes on, remove lock mechanism and inspect jamb switch. Repair as required.
4. If lamp remains off, disconnect single dark green wire connector near fuse block and ground the male connector.
5. If lamp comes on, there is an open in the 18 dark green wire between that connector and the lock mechanism.
6. If lamp remains off, remove instrument panel pad (note 59a) and check for burned out bulb.
7. If bulb is okay, remove instrument panel top cover (note 60a) enough to check for proper connection of printed circuit connector and proper position of terminals in connector.
8. If bulb and connector are both okay, remove connector and check 18 dark green wire (#15 terminal) for continuity between printed circuit connector and single connector near fuse block.
9. If wire is continuous, replace instrument cluster printed circuit.

b. Trunk Lid Closed - Lamp On

1. Open trunk lid and short across latch mechanism to move lock to closed position.
2. Turn ignition switch on. Remove cover panel from lock mechanism and remove 18 dark green wire from behind lock mechanism.
3. If lamp goes off, remove lock mechanism and inspect jamb switch for grounded condition.
4. If lamp remains on, disconnect single dark green connector near fuse block.
5. If lamp goes off, the 18 dark green wire is grounded between the connector and the lock mechanism.
6. If lamp remains on, remove instrument panel pad (note 59a) and partially remove top cover (note 60a) until printed circuit connector may be inspected for proper connection.
7. If connector is okay, remove connector and check the 18 dark green wire (#15 terminal) for a grounded condition between printed circuit connector and single connector near fuse block.
8. If wire checks okay, replace printed circuit.

26. Brake Combination Valve and Park Brake Lamp ("Brakes")

The "brakes" warning lamp should glow (red) during engine cranking or when the park brake is applied and ignition is "on" and be off at all other times.

a. Lamp Off During Cranking

1. Check for blown 5 amp "gages" fuse.
2. Turn ignition switch on. Remove 18 black wire from brake combination valve and ground wire. If lamp comes on, proceed to step 7.
3. If lamp remains off, remove instrument panel pad (note 59a) and check for burned out indicator bulb.
4. If bulb is okay, partially remove instrument panel cover and inspect printed circuit connector.
5. If bulb and connector are okay, remove printed circuit connector and check the 18 tan wire (terminal #11) for continuity between the connector and the brake combination valve wire.
6. If wire is continuous, replace printed circuit.
7. If lamp comes on as a result of grounding the

BACK TO INDEX
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combination valve wire (Step 2), remove screws securing steering column to mounting bracket and lower column until access to ignition switch is gained.

8. Ground the 18 tan/white wire at the ignition switch (ignition switch on).

9. If lamp comes on, replace ignition switch.

10. If lamp ramains off, the 18 tan/white wire between the ignition switch and telltale connector is open.

b. Lamp On With Ignition Switch On and Park Brake Released

1. Disconnect the 18 black wire from the brake combination valve.

2. If lamp goes out, the combination valve or brake system has malfunctioned.

3. If lamp remains on, disconnect park brake warning switch connector.

4. If lamp goes out, replace switch.

5. If lamp remains on, leave 18 tan wire at park brake switch and 18 black wire at combination valve disconnected and remove screws securing steering column to support bracket and allow column to drop for access to ignition switch.

6. Disconnect multiple connector at ignition switch.

7. If lamp goes out, replace ignition switch.

8. If lamp remains on, remove instrument panel pad (note 59a). Disconnect the printed circuit connector and check the following wires for a ground condition:

a. 18 black wire between left bulkhead connector "DU" terminal and brake combination valve.

b. 18 tan wire between printed circuit connector and the "DU" terminal of the left bulkhead connector and the 18 tan/white wire at the ignition switch.

c. 18 tan wire between left bulkhead connector and the brake warning switch.

9. If wires check okay, replace printed circuit.

27. Oil Pressure Indicator Circuit ("Stop Engine Oil Pressure")

The oil pressure indicator light is connected in a circuit with the ignition switch and a pressure operated switch threaded into the oil header galley at rear of engine. Indicator light warns driver when oil pressure is below 4 pounds ± 1-1/2 pounds.

The lamp should glow (red) when the ignition switch is on but the engine is not running. The lamp should go out immediately after the engine is started and remain out during engine operation.

a. Ignition On - Lamp Off - Engine Not Running

1. Check for blown 5 amp. "gages" fuse.

2. Disconnect 18 dark blue wire at oil pressure switch and ground wire using jumper wire. If lamp glows, oil pressure switch is open and should be replaced.

(NOTE: Sealing compound on threads of switch may cause this condition and should never be used.)

3. If lamp remains off, remove instrument panel pad (note 59a) and check for burned out indicator bulb.

4. If bulb is okay, partially remove top cover (note 60a) until printed circuit connector may be inspected for proper connection.

5. If connector is okay, remove connector and check the 18 dark blue wire (terminal #5) for continuity between connector and oil pressure switch.

6. If wire has continuity, replace printed circuit.

7. If an open condition is indicated by the continuity, check inspect engine harness connector. Repair wire as required.

b. Engine Running - Lamp On

1. Disconnect 18 dark blue wire at oil pressure switch.

2. If indicator lamp goes off, the oil pressure switch is shorted or the engine has low oil pressure. If a new switch does not provide proper indicator lamp operation, remove switch and test engine oil pressure using a reliable pressure gage. If pressure is okay, replace switch.

3. If lamp remains on, remove instrument panel pad (note 59a) and partially remove top cover (note 60a) until printed circuit connector is serviceable.

4. Inspect printed circuit connector for proper connection.

5. If connector is okay, remove connector and test 18 dark blue wire (terminal #5) for continuity between printed circuit connector and oil pressure switch connector.

6. If wire is okay, replace printed circuit.

28. Water Temperature Indicator Circuit ("Coolant Temperature")

The amber "coolant temperature" lamp should glow during engine cranking and whenever coolant temperature is excessive, 260°F (127°C) or higher.

a. Lamp Off During Cranking

1. Check for blown 5 amp. "gages" fuse.

2. Turn ignition switch on. Disconnect 18 dark green wire to temperature sender at connector near A/C compressor and ground wire from bulkhead connector.

3. If lamp comes on, replace temperature sender.

4. If lamp remains off, remove instrument panel pad (note 59a) and inspect for burned out lamp.

5. If lamp is okay, partially remove top cover (note 60a) and inspect printed circuit connector.

6. If lamp and connector are okay, remove screws securing steering column to bracket and lower column to gain access to ignition switch.

7. Ground the 18 dark green wire at the ignition switch.

8. If lamp comes on, replace ignition switch.

9. If lamp remains off, check the following wires for continuity:

a. 18 dark green wire between printed circuit connector (terminal #3) and ignition switch.

b. 18 dark green wire between printed circuit connector (terminal #3) and temperature sender connector.

10. If wires are continuous, replace printed circuit.

BACK TO INDEX

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b. Lamp Is On When Ignition Is On

1. Disconnect 18 dark green wire to temperature sender at connector near A/C compressor.
2. If lamp goes out, replace temperature sender.
3. If lamp remains on, remove screws securing steering column to bracket and lower column to gain access to ignition switch.
4. Disconnect 18 dark green wire from ignition switch.
5. If lamp goes out, replace ignition switch.
6. If lamp remains on, remove instrument panel pad (note 59a) and partially remove top cover (note 60a) for access to printed circuit connector.
7. Disconnect printed circuit connector and check the following wires for a grounded condition:

a. 18 dark green wire between printed circuit connector (terminal #3) and temperature sender connector.

b. 18 dark green wire between printed circuit connector (terminal #3) and ignition switch.

8. If wires are okay, replace printed circuit.

29. Seat Belt Warning Light and Buzzer ("Fasten Belts") (Fig. 12-22)

(NOTE: A cool down period of approximately 30 seconds should be allowed between successive functional checks of the system. If the cool-down is not allowed, the system may be inoperative.)

Operation of System

1. With driver's seat belt buckled, and the ignition "on", the telltale "seat belt" light should come on for approximately 4-8 seconds.
2. With the driver's seat belt unbuckled and the ignition in "on", the "seat belt" light and the seat belt warning buzzer should come on for 4-8 seconds.

a. Light Does Not Come On

1. Remove instrument panel pad (note 59a) and check for burned out bulb.
2. If bulb is okay, inspect printed circuit for an open conductor or connector and for proper connection. Replace if damaged.
3. If properly connected, remove connector from printed circuit and check for voltage at terminal #13 (pink/white wire) with ignition on.
4. If voltage is not available, the pink/white wire is open between the timer and the #13 terminal of the printed circuit connector.
5. If voltage is available, check the 18 black wire (terminal #12) for continuity between the connector and the timer.

b. Light Will Not Go Out

1. Remove instrument panel pad (note 59a). Remove printed circuit connector.
2. Check 18 pink/white wire (terminal #13) for grounded condition.
3. If wire is okay, check printed circuit or timer for a shorted condition.

c. Buzzer Does Not Operate (Telltale Light Operates)

1. Check for voltage at 18 wire at timer/buzzer connector. Connect test light to ground. Sit in driver's seat, seat belt unbuckled and turn ignition on.
2. If voltage is not available repair open in 18 wire. Turn Ignition off.
3. If voltage is available connect a jumper wire from the 18 pink/white wire at the buzzer to ground. Turn ignition on.
4. If buzzer does not operate, replace timer/buzzer.
5. If buzzer does operate check for open in 18 pink/white wire.
6. If wire is not open, connect a self powered test light to seat belt retractor connector. Do not sit on seat.
7. If test light does not glow, replace seat belt retractor switch.
8. If test light glows check 18 black wire (body side) at seat belt retractor connector to make certain it is grounded.
9. Replace timer/buzzer if all above tests do not indicate a problem.

30. Engine Metal Temperature Indicator Circuit ("Stop Engine Temperature")

In addition to indicating an engine overheating condition, the red "stop engine temperature" warning lamp should come on whenever the ignition key warning buzzer sounds (key in lock, ignition off and driver's door is open.

System Circuitry

When engine metal temperature exceeds 320°F, the engine temperature switch closes. Current from the horn circuit breaker flows through the orange with black stripe wire, through the relay coil, through the normally closed contact points, through the 18 white wire to the bulkhead connector. The current then flows through the left bulkhead connector "DX" cavity, through the 18 light green wire to the engine temperature sending unit switch, and then through the switch to ground.

When the engine metal temperature switch is closed, the ground is also completed for the engine metal temperature tell-tale light that is fed from the horn circuit breaker through the 16 orange with black stripe wire. Current flows through the engine metal temperature tell-tale light, illuminating this light, through the light green wire to the left bulkhead connector, through the 18 light green wire to ground at the switch.

When the relay coil is energized, the normally closed contacts open, breaking the circuit and de-energizing the coil. This, in turn, allows the normally closed contacts to close again, completing the circuit and energizing the coil again. As the normally closed contacts open and close in rapid succession, the buzzer sound is produced.

BACK TO INDEX

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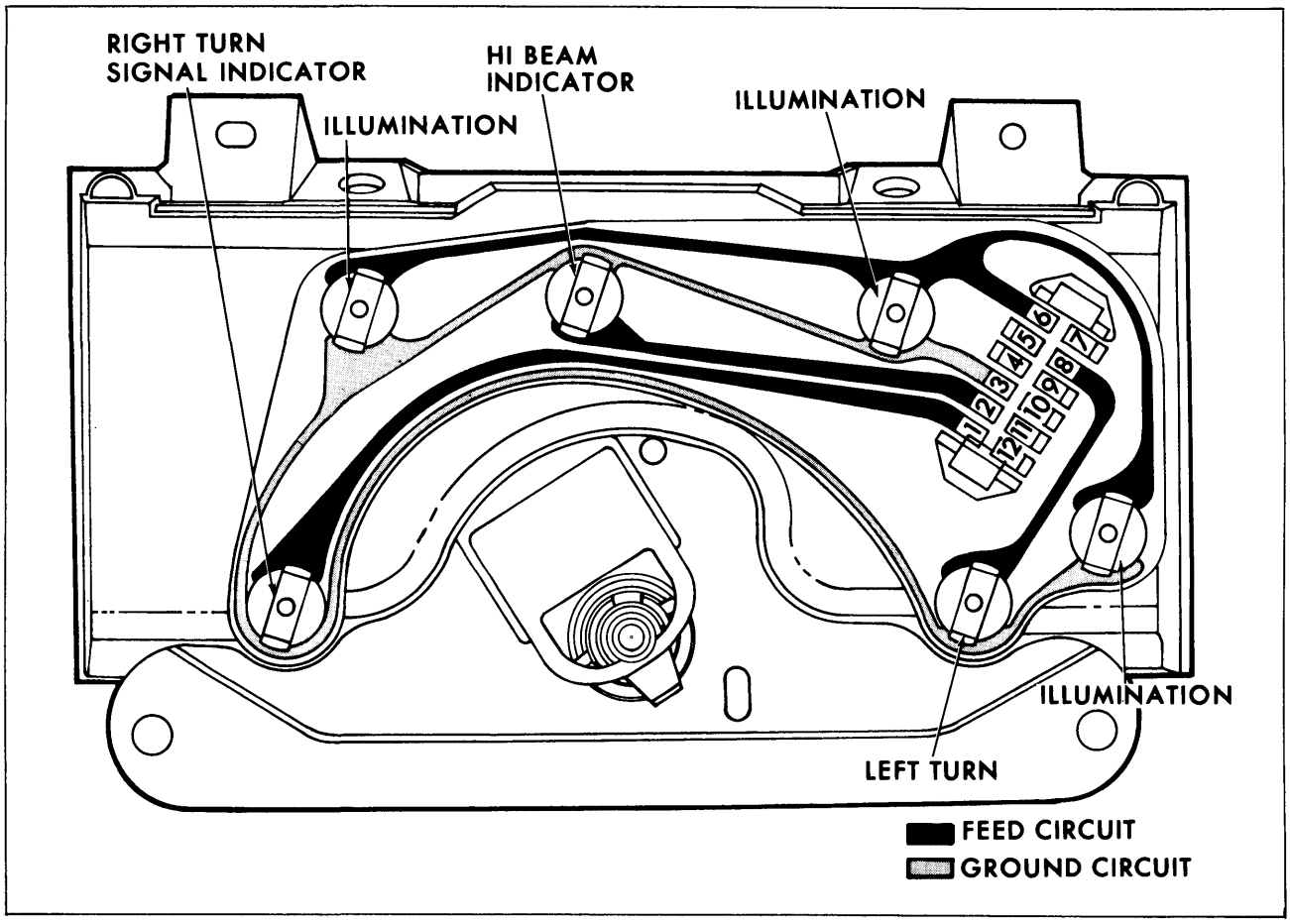


Fig. 12-25 Speedometer Cluster Printed Circuit

SPEEDOMETER PRINTED CIRCUIT LEGEND

No. and Circuit		Wiring Color Code
1	R.H. Turn Indicator	18 Dark Blue
2	HiBeam Indicator	18 Light Green
3	Ground	16 Black
4	Not Used	
5	Not Used	
6	Illumination	18 Gray
7	Not Used	
8	L.H. Turn Indicator	18 Light Blue with Black Stripe
9	Not Used	
10	Not Used	
11	Not Used	
12	Not Used	

(NOTE: When engine metal temperature exceeds 320°F, energizing the warning buzzer coil, it will continue to buzz until the engine cools below 240°F, even with the ignition switch turned Off.)

a. Lamp Fails To Come On

1. Disconnect the 18 light green wire from the metal temperature switch at the rear of the left cylinder head and ground the wire.

BACK TO INDEX

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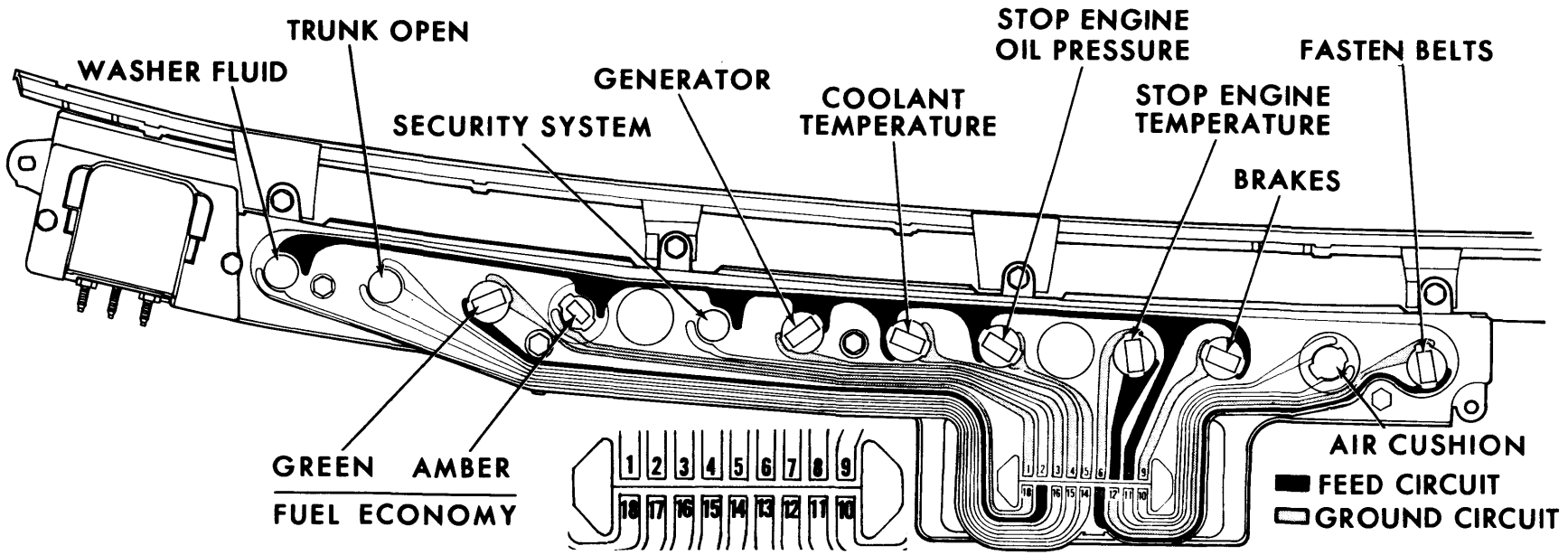


Fig. 12-26 Telltale Cluster Printed Circuit

BACK TO INDEX

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TELLTALE CLUSTER PRINTED CIRCUIT LEGEND

No. and Circuit		Wiring Color Code
1	Generator (Ground)	16 Brown
2	Generator (Feed) (Ignition B+)	18 Yellow
3	Coolant Temperature	18 Dark Green
4	Not Used	
5	Stop Engine – Oil Pressure	18 Dark Blue
6	Engine Metal Temperature (Ground)	18 Purple w/White Stripe
7	Engine Metal Temperature (Feed)	16 Orange w/Black Stripe
8	Ignition (Feed Circuit)	18 Pink
9	Air Cushion	18 Purple
10	Air Cushion	18 Light Green
11	Low Brake and Park Brake	18 Tan and 18 Tan w/White Stripe
12	Fasten Seat Belts (Ground)	18 Black
13	Fasten Seat Belts (Feed)	18 Yellow w/Black Stripe
14	Washer Fluid	18 Black w/White Stripe
15	Trunk Open	18 Dark Green
16	Not Used	
17	Green Dot – Economy	18 Yellow
18	Amber Dot – Economy	18 White

2. If lamp comes on and buzzer sounds, replace temperature switch.
3. If lamp remains off, check for an open horn circuit breaker.
4. If circuit breaker is okay, remove instrument panel pad (note 59a) and check for burned out bulb.
5. If bulb is okay, partially remove top cover and inspect printed circuit connector.
6. If bulb and connector are okay, remove printed circuit connector and check for continuity between terminal #6 and temperature switch (18 light green).
7. If continuity is indicated, check for voltage at the #7 terminal of the printed circuit connector (16 orange/black wire).
8. If voltage is indicated, there is an open in the 18 light green wire between the #6 printed circuit connector and the "DX" cavity of the left bulkhead connector and the temperature switch.
9. If voltage is not indicated, there is an open in the 16 orange/black wire between the connector and the fuse block.

b. Lamp Fails To Go Out

1. Disconnect 18 light green wire at metal temperature switch at rear of left cylinder head.
2. If lamp goes out, replace temperature switch.
3. If lamp remains on, the 18 light green wire between the temperature switch, the "DX" cavity of the left bulkhead connector and terminal #6 of the printed circuit connector is grounded.

31. Horn Operation and Testing (Fig. 12-27)

Conditions that may affect horn performance and

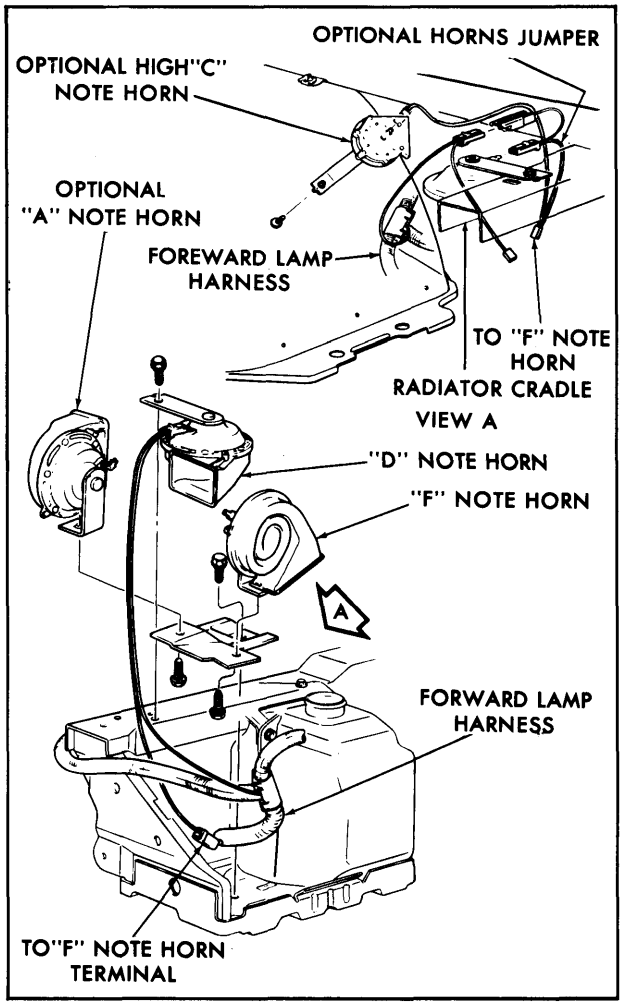


Fig. 12-27 Horns and Mounting Bracket

BACK TO INDEX

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procedures for checking these conditions are listed below:

1. Actuate horn by depressing the steering wheel pad in any area. Horn should blow. If horn fails to blow, proceed to Step 2.
2. While horn is energized, tap horn lightly. If horn blows, proceed to Step 3. If horn fails to blow, refer to Step 6 of this procedure.
3. Release cushion so that horn will stop blowing.
4. Energize horn again. If horn blows normally, a particle of foreign material between the contact points caused the trouble and no adjustment is necessary.
5. If horn still fails to blow when tapped, turn adjustment screw, Fig. 12-28, one full turn counterclockwise.

(NOTE: This adjustment is sensitive. Do not turn screw more than one full turn or in wrong direction (clockwise). Misadjustment will require removing horn for adjustment on bench as described in Part d of this Note.)

6. Check horn for normal operation. If still inoperative, inspect circuit breaker to assure power is available, then perform the following checks.

a. Connect a jumper lead to number "3" and number "1" terminals of horn relay. If horn blows, trouble is in relay, steering wheel pad switching or wiring. Remove jumper lead.

b. To determine whether steering wheel pad switches or wiring is at fault, ground number "2" terminal of relay. If horn blows, pad contacts or wiring is at fault.

c. Use a jumper from an area cleared of paint on horn bracket to grounded metal on radiator cradle, check for no ground due to corrosion or paint on bolt threads. If horn blows, clean bolt threads and horn bracket surfaces which mate with radiator cradle.

d. If horn does not blow and wiring between battery and relay is okay, connect a voltmeter between terminal on the horn and a paint free area on the radiator cradle. Connect a jumper lead to number "3" and number "1" terminals of relay and note voltmeter reading.

e. If no voltmeter reading is obtained, wiring between relay and horn is open.

f. If voltmeter reading is less than 7.0 volts, trouble is due to high resistance connections in battery connection or wiring.

g. If voltmeter reading is above 7.0 volts, trouble is due to a faulty horn. In this case, test horn for current draw.

7. If no trouble is located during these checks and horn is still inoperative, remove horn for a bench check.

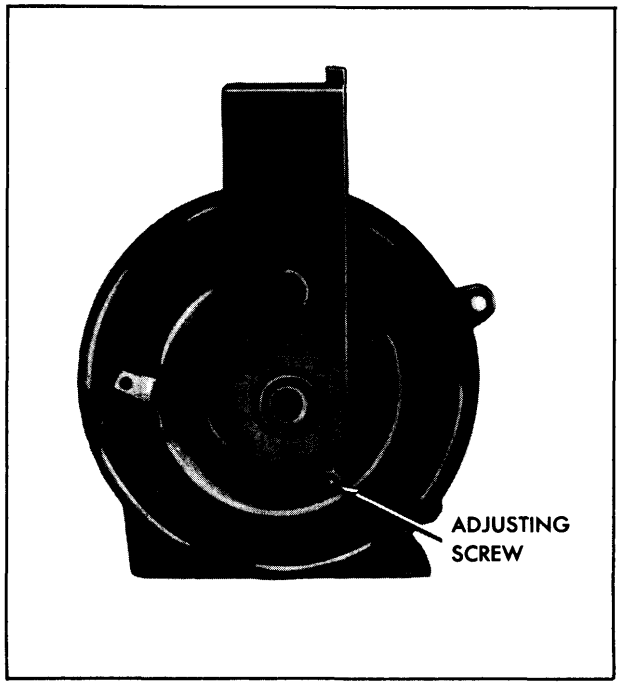


Fig. 12-28 Horn Adjusting Screw

a. Horn Tone Poor

1. Harsh tone – caused by loose bolts in sheet metal mounting area.
2. Low pitch moan – sounds like "moo-ing" and is caused by too high a current. Horn needs adjusting.
3. Weak tone – caused by too low a current. Horn needs adjusting.
4. Weak strained tone – foreign body in horn trumpet that should be shaken out or removed.
5. Harsh vibration – caused by horn touching sheet metal. Bracket should be bent to give horn clearance and freedom from interference.

b. Horn Blows Constantly

1. This can be caused by sticking horn contacts in the relay, or horn pad.
2. Horn relay may be energized by grounded or shorted wiring.

(NOTE: Burned open windings on most horns are caused by one of the above malfunctions. Before horns with open windings are replaced by new horns, make sure that none of the above conditions exist, or the horn windings will again burn open.)

c. Bench Checks

1. Measure current draw of horn while horn is operating. Current draw for each horn should be between 4.5 and 5.5 amperes at 11.5 to 12.5 volts.
2. No current may indicate a broken connection or an open circuit due to a broken lead or to overheating. Most horn problems are caused by horns being operated continuously, which develops sufficient heat to melt the wires in the winding, causing an open circuit. Overheating is accompanied by a characteristic odor which indicates that horn has overheated and should be replaced.
3. No current can also indicate that the contact points are open and a current adjustment is required. Turn adjusting screw counterclockwise.

BACK TO INDEX

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4. High current, over 20 amperes, indicates an overheated winding or shorted horn which should be replaced.

5. A reading of approximately 18 amperes for a 12-volt horn indicates a condition in which the contact points are not opening. A current adjustment is required by turning the adjustment screw clockwise.

d. Current Adjustment

Turn adjusting screw, Fig. 12-28, counterclockwise to increase current or clockwise to decrease current until specified current is reached. Care must be taken not to turn the adjusting screw too far. Turn screw 1/4 of a turn at one time. If adjustment loosens the screw excessively, it may be staked with a punch.

e. Cold Weather Adjustment

If horn fails to blow in cold weather, it is possible that current limit is set too low although still within 4.5 – 5.5 ampere limit (each horn) at 12.0 volts. Turn adjusting screw 1/4 turn counterclockwise (90°) to increase draw, Fig. 12-28.

CAUTION: This adjustment should not be made unless horn fails to blow. A current increase on a properly operating horn can result in complete malfunction of the horn.

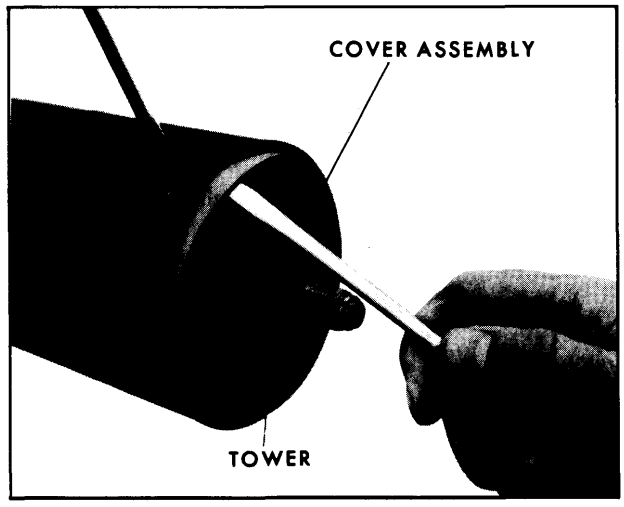


Fig. 12-29 Cover Plate and Mounting Screws

32. Clock Resetting

The reset knob projects from the upper right hand corner of the clock. To reset, pull reset know all the way out and turn until desired time is obtained. When resetting, be sure numbers are centered in window. After resetting, push knob all the way in.

If timekeeping characteristics of the clock become erratic, it should be removed and sent to the manufacturer.

SERVICE INFORMATION

33. Turn Signal Switch Replacement—Standard Column

If car is equipped with Air Cushion Restraint System, refer to 1975 ACRS service manual for procedures specific to the ACRS steering column.

1. Disconnect negative battery cable.
2. Remove steering wheel as described in Section 9, Note 27a.
3. Using a thin blade screw driver remove lock plate cover assembly, Fig. 12-29.
4. Install spring compressor J-23131, on steering shaft, Fig. 12-30.
5. Compress lock plate and spring. Remove snap ring and discard, Fig. 12-30.

CAUTION: Shaft could slide out of bottom of column when snap ring is removed, causing damage to shaft.

6. Remove lock plate by sliding up and off upper shaft.
7. Slide turn signal cancelling cam, upper bearing preload spring and thrust washer off upper steering shaft.

CAUTION: Care should be taken at this point as steering shaft is free to move and could slide out of column.

8. Remove lower steering column cover as described in Note 58a.
9. Remove screw securing turn signal lever and remove lever from column.

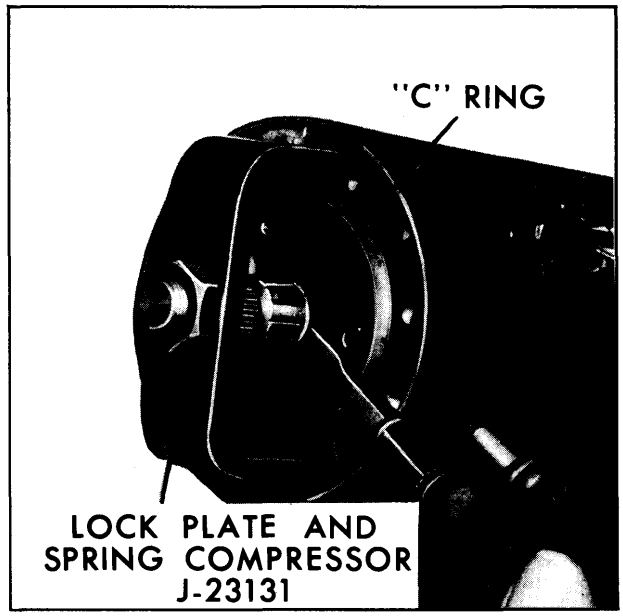


Fig. 12-30 Removing and Installing "C" Ring

BACK TO INDEX

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10. Remove two vertical bolts at steering column upper support. Remove shim packs, maintain shims as a unit, for installation.

11. Remove four screws (2 each side) securing column upper mounting bracket to column and remove bracket.

12. Disconnect turn signal harness from car harness and remove wires from plastic protector.

13. Remove three screws securing turn signal switch to column and pull switch out of position in shift bowl.

14. If switch is known to be bad, cut wires from switch and discard switch. Tape new switch connector to old harness and carefully pull new harness down through column as old harness is removed. Proceed to Step 16.

15. If existing switch is to be reused, wrap a piece of tape around the harness and a length of wire as shown in Fig. 12-31, and carefully pull the harness up through the column.

16. To install switch, tape end of harness to wire as shown in Fig. 12-31 and carefully feed harness down through column.

17. Secure switch to shift bowl with three screws.

18. Install thrust washer, upper bearing preload spring and turn signal cancelling cam on steering shaft.

19. Install lock plate with large flat on plate aligned with flat on steering shaft.

20. Place a new snap ring on upper end of steering shaft.

21. Install spring compressor, J-23131, on steering shaft, Fig. 12-30.

22. Compress lock plate and spring and slide new snap ring down shaft until ring locks in groove.

23. Remove spring compressor, J-23131.

24. Position cover plate to steering column and secure with three screws.

25. Install steering wheel as described in Section 9, Note 27b.

26. Install turn signal lever and secure with screw.



Fig. 12-31 Taping Turn Signal Switch Connector

27. Remove tape from end of harness and connect switch and cruise control (if equipped) to car harness.

28. Cover both harnesses with plastic protector and position to column. Turn signal connector slides on tabs of column.

29. Position steering column upper bracket over turn signal switch harness plastic protector and install four screws holding bracket to column (2 each side). Tighten screws to 20 foot-pounds.

30. Loosely install two vertical mounting bracket screws. Install shims in same quantity and location as found when bracket was removed.

31. Align steering column as described in Section 9, Note 68b, Steps 7 through 13. Tighten vertical screws to 20 foot-pounds.

32. Install lower steering column cover as described in Note 58b.

34. Turn Signal Switch Replacement—Tilt and Telescope Column

1. Disconnect negative battery cable.

2. Remove steering wheel as described in Section 9, Note 27a.

3. Slide rubber sleeve bumper from steering shaft.

4. Remove plastic retainer, using small screwdriver to disengage tabs on retainer from C-ring.

5. Install spring compressor J-23063 on steering shaft, Fig. 12-32, threading bolt into steering shaft lock hole.

(NOTE: When installing spring compressor, pull upper shaft up 1" from bottomed position then turn ignition to Lock to hold shaft in place.)

6. Compress upper steering shaft preload spring and remove C-ring, Fig. 12-32.

7. Remove spring compressor, J-23063, and remove upper steering shaft lock plate, horn contact carrier and upper steering shaft preload spring.

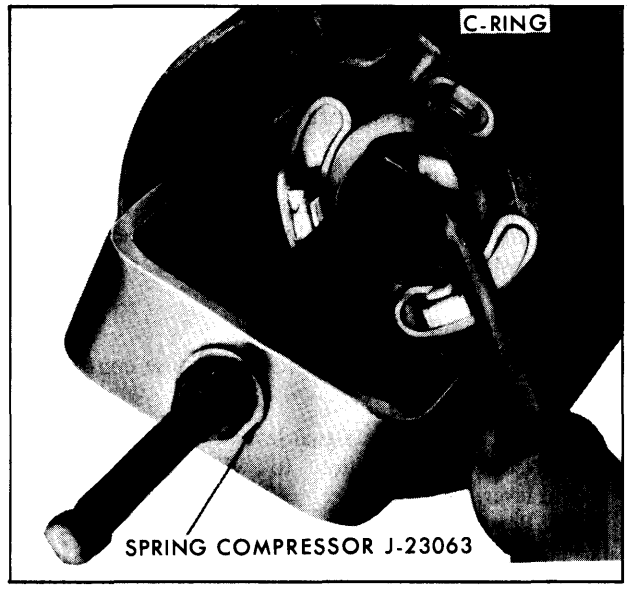


Fig. 12-32 Installing Spring Compressor

BACK TO INDEX

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8. Remove lower steering column cover as described in Note 58a.

9. Unscrew turn signal lever and remove lever from column.

(NOTE: On cars equipped with cruise control, perform the following procedure.)

a. Disconnect cruise control wire from car harness near bottom of column.

b. Slide harness protector off of cruise control wire.

c. Wind wire around turn signal lever until lever is disconnected. Do not remove wire from column.

10. Remove two vertical bolts at steering column upper support. Remove shim packs. Maintain shims as a unit, for installation.

11. Remove four screws (2 each side) securing column upper mounting bracket to column and remove bracket.

12. Disconnect turn signal harness from car harness and remove wires from plastic protector.

13. Remove three screws securing turn signal switch to column and pull switch out of position in shift bowl.

14. If switch is known to be bad, cut wires from switch and discard switch. Tape new switch connector to old harness and carefully pull new harness down through column as old harness is removed. Proceed to Step 16.

15. If existing switch is to be reused, wrap a piece of tape around the harness and a length of wire as shown in Fig. 12-31, and carefully pull the harness up through the column.

16. To install switch, tape end of harness to wire as shown in Fig. 12-31 and carefully feed harness down through column.

17. Secure switch to shift bowl with three screws.

18. Install upper steering shaft preload spring.

19. Install lock plate and carrier assembly.

(NOTE: When installing lock plate and carrier assembly, make sure flat on lower end of steering shaft is pointing up and that the small plastic tab on the carrier is up or nearest the top of the shift bowl. Flat surface of lock plate must be installed facing down (against turn signal switch.)

20. Install spring compressor, J-23063. Compress preload spring and lock plate and install C-ring with wide side toward keyway.

21. Remove spring compressor, J-23063.

22. Install plastic retainer on C-ring.

23. Install rubber sleeve bumper over steering shaft.

24. Install steering wheel as described in Section 9, Note 27b.

25. Install turn signal lever.

(NOTE: On cars equipped with cruise control, use the following procedure.)

a. Rotate the turn signal lever exactly 6 times in a counterclockwise direction to wind harness tightly around lever.

b. Position lever to switch and screw in. Unwind harness as lever is installed.

26. Remove tape from end of harness and connect switch and cruise control (if equipped) to car harness.

27. Cover both harnesses with plastic protector and position to column. Turn signal connector slides on tabs of column.

28. Position steering column upper bracket over turn signal switch harness plastic protector and install four screws holding bracket to column (2 each side). Tighten screws to 20 foot-pounds.

29. Loosely install two vertical mounting bracket screws, Install shims in same quantity and location as found when bracket was removed.

30. Align steering column as described in Section 9, Note 6b, Steps 7 through 13. Tighten vertical screws to 20 foot-pounds.

31. Install lower steering column cover as described in Note 58b.

35. Back-Up Light Switch (Fig. 12-33)

The back-up light switch, and parking brake vacuum release valve are combined into one unit mounted on the steering column under the instrument panel. A separate specific back-up light switch is used on cars equipped with automatic door locks.

a. Removal

1. Place transmission shift lever in NEUTRAL position.

2. Remove screw in clamp and carefully remove switch and clamp from steering column, being careful not to disturb position of contact carrier.

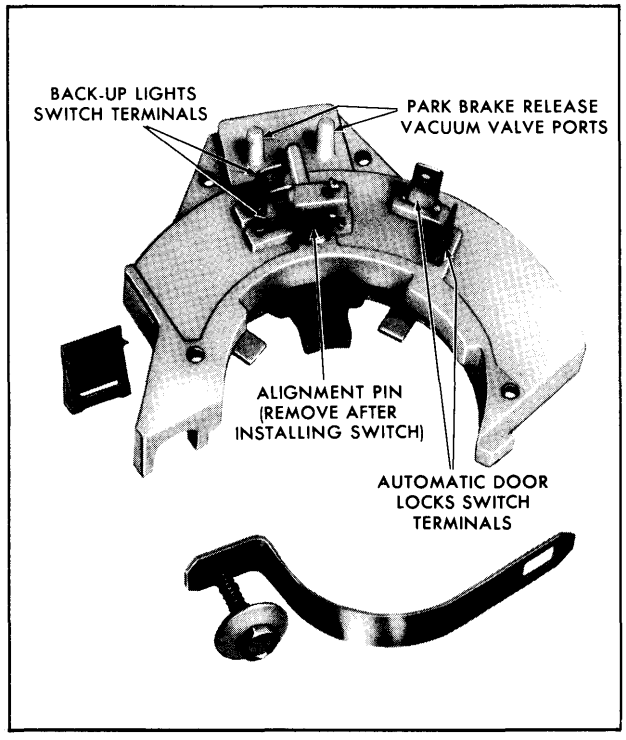


Fig. 12-33 Back-Up Light Switch

BACK TO INDEX

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3. Mark position of contact carrier.
4. Mark top vacuum hose for identification and remove hoses.
5. Disconnect wiring connector(s) from switch.

b. Installation

1. Place transmission shift lever in NEUTRAL detent.
2. Connect wiring connector(s) to switch.
3. Move contact carrier on switch assembly to neutral position as marked during removal. If necessary to install a new switch, the switch will be secured in neutral by an alignment pin. Do not remove pin.
4. Install switch assembly on steering column, aligning contact carrier blade with slot in shift tube. With switch tight against column, slide switch down column until bosses on casting rest on bottom edge of slot in outer jacket. Bosses extend below the mounting surface.
5. Place clamp on switch and install screw to tighten clamp, making sure that shift lever is in NEUTRAL detent while this operation is performed.
6. Connect vacuum hoses to switch as marked during removal.
7. Switch should now be properly adjusted. If new switch was installed, it will be necessary to remove the alignment pin.
8. Check to be certain that back-up lights come on in REVERSE and that the park brake will release in drive. If car is equipped with automatic door locks check be certain that doors lock when in DRIVE with driver's seat occupied and ignition "ON".

LAMP MONITOR SYSTEM

THEORY OF OPERATION

The Lamp Monitor system is standard equipment on all cars. It allows the driver to visually check the operation of the exterior lamps without leaving the vehicle. This is accomplished through the use of light conductors. The conductors are used to transfer light from the individual exterior lamp to its respective monitor Fig. 12-33. The system does not use electrical power in order to operate, nor does it have any moving parts.

Three individual lamp monitors are used. One monitor is mounted on top of each front fender, and one at the center of the headliner, immediately above the rear window. On convertibles, the rear monitor is mounted to the back of the rear seat.

The front lamp monitor high beam headlamp indicator lens is blue and thus matches the high beam headlamp indicator in the speedometer face. The high beam fiber optic has a blue identification marking near each end.

The front lamp monitor low beam headlamp indicator lens is clear. The fiber optic transmits the light directly from the low beam headlamps and is identified by a white marking near each end.

The park and turn signal lamp monitor lens is, also clear. The fiber optic transmits the amber light from the park and turn signal lamp. There is no marking on the fiber optic.

Fiber optic identification and positioning are shown in Figs. 12-7, 12-8, 12-9, 12-11, 12-12 and 12-13.

Each lamp monitored, except headlamps, has a pickup mounted in the housing; the headlamp pickup is located in the connector on the wiring harness and picks up the light from the sealed beam unit nipple.

The rear monitor indicates each tail lamp on the respective side of the vehicle.

Refer to body service manual for servicing rear lamp monitor.

DIAGNOSIS

36. Monitor Inoperative

1. Check bulb in lamp connected to inoperative monitor.
2. If bulb is burned out, replace bulb. If lamp operates normally, proceed with further checks.
3. Check for proper installation of conductors to sealed beam or lamp housing as required. If correct, proceed to Step 4.
4. Check conductor harness mounting to lamp monitors for proper attachment.
5. Check conductor harness routing for pinched or severely bent condition.
6. If none of the above checks reveals the inoperative condition, the conductor light fibers have probably been damaged. Replace conductors as required.

37. Front Monitor Harness

a. Removal

1. Open Hood.
2. Disconnect conductor harness from front lamps.
3. Reach under fender and remove two nuts from

BACK TO INDEX

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read-out mounting studs and raise read-out from fender.

4. Detach monitor connector from read-out and remove read-out.

5. Remove read-out connector with conductors harness by pulling out through hole in top of fender.

b. Installation

1. Install lamp end of conductors down through hole in top of fender.

2. Route harness and install conductor ends into respective lamps.

3. Install monitor connector on read-out and position read-out on front fender.

4. Reach under fender and install two nuts on read-out mounting studs to secure read-out to fender.

5. Check operation of read-out. If satisfactory, close hood. If not, check installation and routing.

38. Front Monitor Read-out Removal and Installation

a. Removal

1. Open hood.

2. Reach under fender and remove two nuts from read-out mounting studs and raise read-out from fender.

3. Detach monitor connector from read-out and remove read-out.

b. Installation

1. Install monitor connector on read-out and position read-out on front fender.

2. Reach under fender and install two nuts on read-out mounting studs to secure read-out to fender.

3. Check operation of read-out. If satisfactory, close hood. If not, recheck installation.

WINDSHIELD WIPER SYSTEM

GENERAL DESCRIPTION

Service information pertaining to the windshield wiper and washer system not found in this section is covered in the Body Service Manual. Information on the controlled cycle wiper system will be found in Section 15 of this manual and in the Body Service Manual.

Windshield Wiper Electrical Operation

LOW SPEED – Moving the control switch lever to the "Lo" speed position, Fig. 12-34, connects the relay control and shunt field circuit directly to ground, Fig. 12-35. This provides the following circuit:

Current feed to the 25 amp windshield wiper fuse in the fuse panel comes from the accessory terminal on the ignition switch. Current flows through the yellow wire to terminal number 2 of the wiper motor. It then flows through the tan wire to one contact point on the relay switch, and on through the relay coil and through the red wire back to terminal No. 1, through the light blue wire and the switch to ground. After passing through the relay points, current flows through the black with double pink tracer wire through the series field and divides; part flowing through the armature and circuit breaker and through the black ground wire, the other part flowing through the shunt field, the solid black wire to terminal number three, and on through the black with double orange tracer wire to ground at the control switch. Current by-passes the 20 ohm resistor ground circuit at terminal No. 3 at this time, because of the lower resistance of the control switch ground circuit.

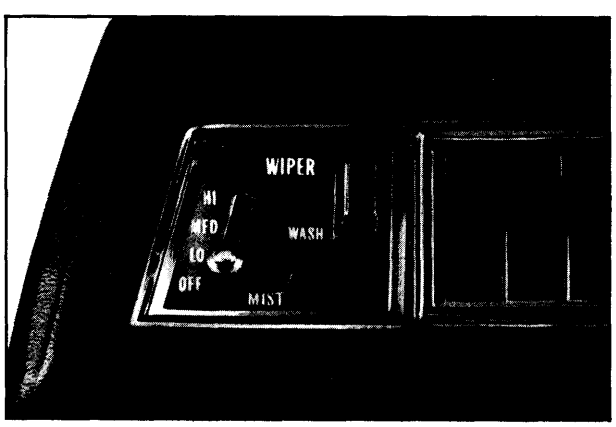


Fig. 12-34 Windshield Wiper Switch

MEDIUM SPEED – Moving the control switch to the "Medium" speed position, Fig. 12-34, connects a 13 ohm resistor, located in the control switch, in parallel with the 20 ohm resistor connected from the shunt field circuit. These two resistors, connected in parallel, provide slightly less than 8 ohms resistance in the shunt field, allowing less current to flow in the shunt field. This permits correspondingly more current in the armature circuit, resulting in medium speed.

HIGH SPEED – Moving the control switch lever to the "High" speed position, Fig. 12-34, eliminates the path to ground in the control switch, leaving only the 20 ohm resistor in the shunt circuit. This one resistor allows even less current to flow through the shunt field than was possible at either medium or low speeds, which results in high speed operation.

MIST – Moving the control lever down to the "Mist" position, Fig. 12-34, and holding there until the wipers move out of the park position before releasing, will allow the wipers to make one complete low speed cycle wipe of the windshield and return to the park position.

Washer Circuit

Depressing the washer button on the control switch, Fig. 12-34, mechanically moves the wiper switch lever to the "Lo" speed position. The washer relay coil is energized by the current flowing from the No. 2 terminal on the wiper unit connector through the yellow wire into the relay coil and from there through the dark blue wire to ground.

BACK TO INDEX

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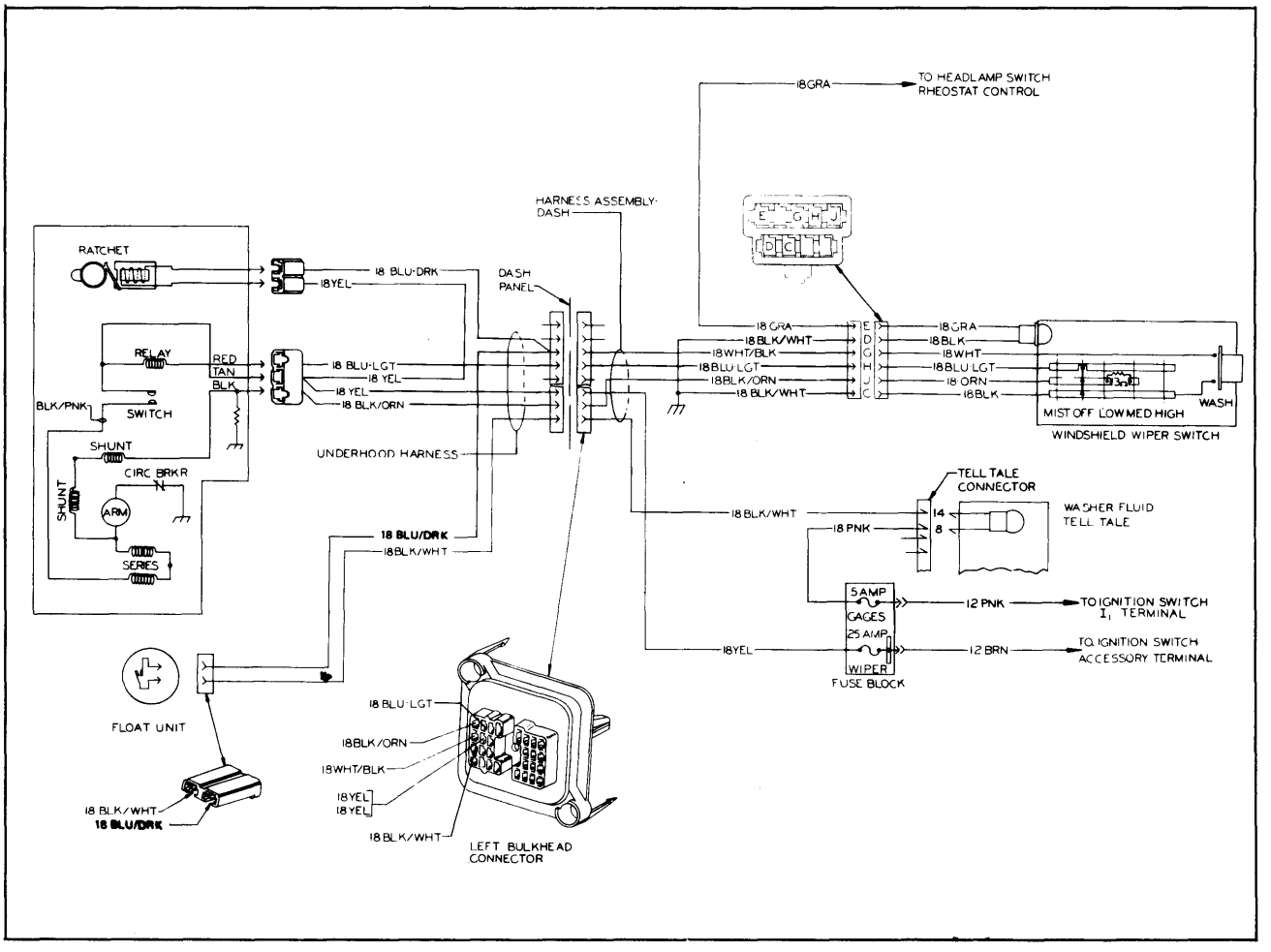


Fig. 12-35 Windshield Wiper Wiring Circuit Diagram

WASHER FLUID LOW LEVEL INDICATOR

GENERAL DESCRIPTION

A washer fluid low level indicator light is provided on all cars as standard equipment. The light is located on the left side of the tell tale housing. It is labeled "WASHER FLUID" and it glows amber when the fluid level in the windshield washer bottle drops below approximately 1/3 full.

Engaging the wipers allows a small amount of current to flow from the wiper motor terminal through a #18 yellow wire to the washer bottle float unit, Fig. 12-36 or 12-37. Two types of float units are used and although different in apperance they may be used interchangeably. When the fluid level in the washer bottle is low, the float drops, which on one design, Fig. 12-36 allows the circular magnet to separate from the cap assembly, on the second design, Fig. 12-37, the spacer drops and releases pressure from the lever assembly which activates an over center spring contact. This permits the contact points within the cap to close, and allows current to flow to the indicator light.

The indicator system operates in conjunction with the windshield wiper motor. A low fluid level condition will not be indicated to the driver unless the fluid level is below 1/3 full, windshield wipers are running and the washer button is depressed.

The complete float and cap unit must be replaced if inoperative.

CAUTION: Use care when handling the float assembly, as the switch can be broken if subjected to a hard impact.

Refer to body service manual for servicing windshield wiper and washer system.

BACK TO INDEX

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DIAGNOSIS

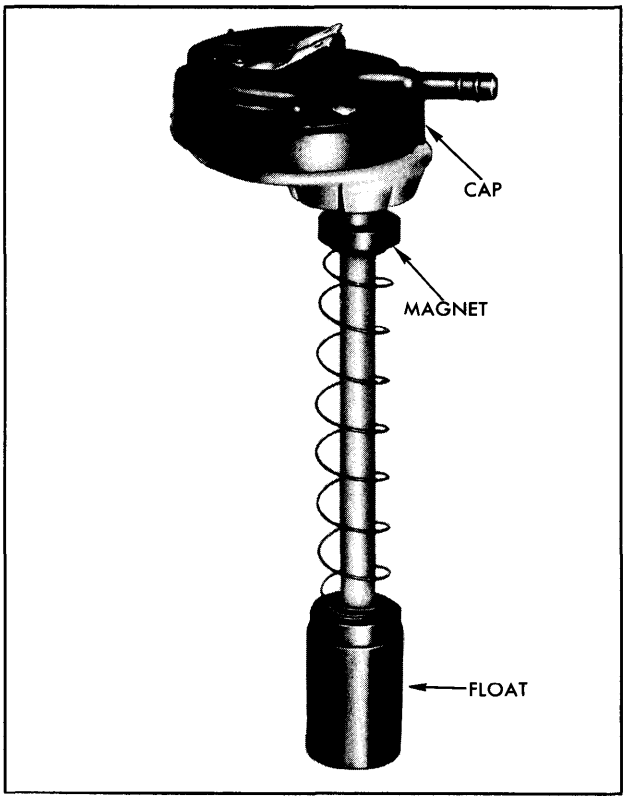


Fig. 12-36 Magnetic Switch Type Float Unit

39. Indicator Inoperative

Before proceeding to the diagnostic procedures make certain that the correct operating procedure for the system has been used. In order for the lamp to glow all the following must be followed.

1. Ignition switch in "RUN" position.
2. Fluid level below 1/3 full (or float unit removed from reservoir).
3. "WASH" button depressed.

If the above has been completed and the lamp does not glow proceed as follows:

4. Check for blown 5 amp. "gages" fuse, Fig. 12-16.
5. Disconnect electrical connector from float unit, Fig. 12-38. Using a jumper wire connect the two wiring terminals to by-pass the float unit.
6. Turn ignition switch to "RUN" position. Depress "WASH" button on windshield wiper switch. "Washer Fluid" telltale should glow. If bulb does not glow, replace bulb.
7. Remove float unit assembly from washer bottle.
8. Connect a self powered test light to float unit terminals. Slide float up and down pick-up tube. Test light should glow when float is lowered and turn off as float is raised. If it does not, replace float unit.
9. If problem exists after float unit has been replaced, check electrical connections at switch, bulkhead connector and windshield wiper switch.

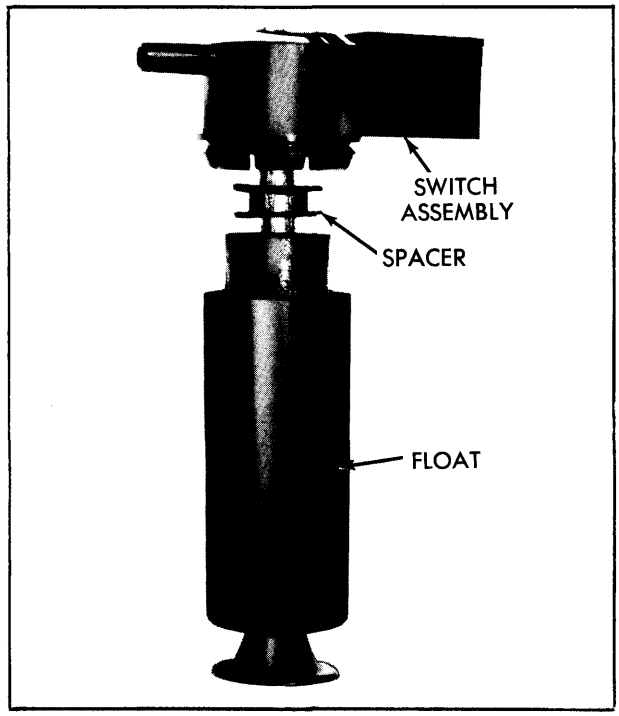


Fig. 12-37 Spring and Lever Type Float Unit

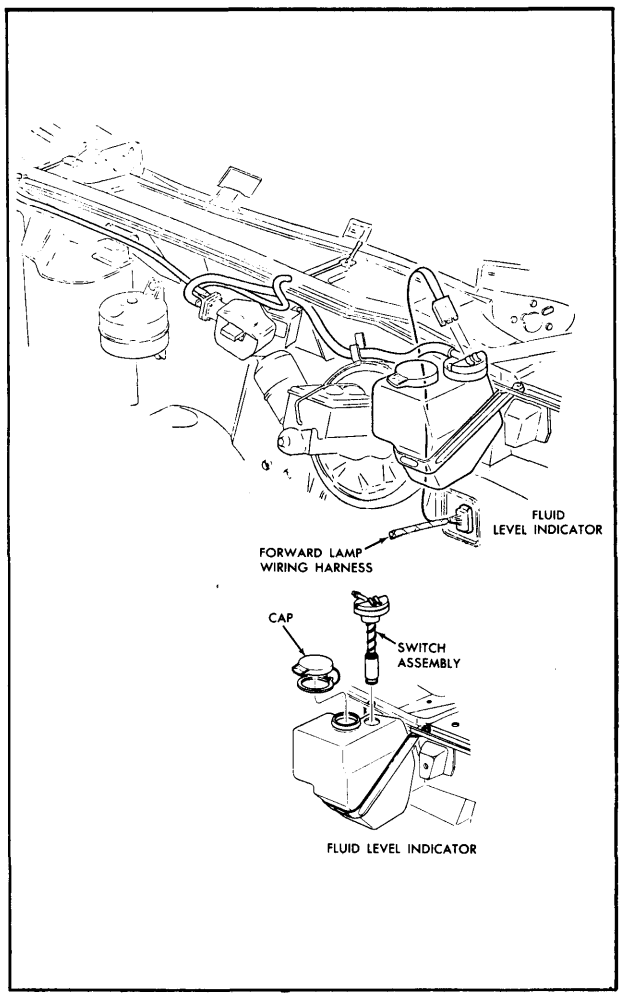


Fig. 12-38 Low Washer Fluid Indicator Installation

BACK TO INDEX

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RADIO AND ANTENNA THEORY AND OPERATION

An AM/FM pushbutton radio is standard on Calais, DeVille and Seventy-five series cars, Fig. 12-39. An AM/FM pushbutton stereo signal seeking radio is standard on Eldorados and Broughams, Fig. 12-40. Optional radios include an AM/FM pushbutton stereo radio with integral eight-track tape player, Fig. 12-41, an AM/FM pushbutton stereo signal seeking with weather band, Fig. 12-42, and for Fleetwood Seventy-five styles, an AM/FM pushbutton stereo signal seeking radio with rear remote controls. The AM/FM pushbutton radio consists of a receiver unit and three separate speaker units. All stereo radios consist of a receiver unit and four separate speaker units.

There are two 3-1/2 inch round front speakers, one at each end of the instrument panel top cover, on all radio installations. Two 6 inch x 9 inch rear speakers, one at each end of the rear filler panel, are used on all stereo installations except convertibles. On convertibles, the rear stereo speakers are mounted behind the rear seat in the well for the convertible top.

On stereo installations, the left front and right rear speakers are on one channel and the right front and left rear speakers are on the other channel.

All receivers are equipped with a frequency band selector bar. Moving the band selector bar to the left, engages the FM band and all preset FM stations. Conversely, moving the selector bar to the right engages the AM band. Any preset station is mechanically tuned in by depressing the appropriate pushbutton located directly below the band selector bar.

An electrically operated, telescoping rod-type antenna, Fig. 12-43, is installed with all radios. This antenna is designed for improved AM/FM fringe area, and FM metropolitan area performance. It is mounted in the right front fender assembly.

There are two controls for the antenna; an automatic control and a manual control. The automatic antenna control is integral with the radio on-off control. The antenna raises to a pre-set height of approximately twelve inches, when the radio is turned on and fully retracts when the radio or ignition switch is turned off.

A manually operated antenna up-down control switch, Fig. 12-44, is located in the accessory switch panel to the right of the steering column. It is used to raise the antenna higher than the pre-set height for fringe area reception, or to lower the antenna when necessary to clear low overhead objects.

Also, placing the manual switch in the full up detent position before turning the radio on will allow the antenna to by pass the twelve inch limit and go to the full up position when the radio is turned on. Turning off the radio or ignition switch fully retracts the antenna even though the manaul switch is left in the up detent position.

The antenna is operated by a reversible electric motor. The motor drives a gear and pulley assembly that extends or retracts a drive cable fastened to the smallest of the three antenna sections. The action of the drive cable, as it is extended, forces the antenna rod upward.

In lowering the antenna, the drive cable is retracted. This pulls the three sections of the antenna rod downward.

CAUTION: Do not raise or lower the antenna by hand. this may damage the operating mechanism.

AM/FM, AM/FM Stereo and AM/FM Stereo Weather Band Radios

The AM/FM, AM/FM Stereo and AM/FM Stereo Weather Band radios have advantages and limitations that must be explained to owners who are not familiar with the operations of FM units.

The frequencies (88-108MHZ) at which FM stations operate create much shorter radio wave lengths than those produced in AM broadcasting. Unlike AM signals, FM signals do not bend around the horizon. This limits the distance at which FM signals can be received. The dependable range of FM reception in an automobile is a radius of approximately thirty miles from the transmitting antenna.

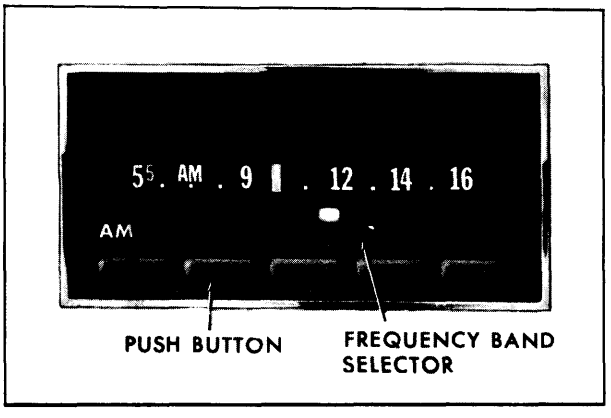


Fig. 12-39 AM/FM Pushbutton Receiver

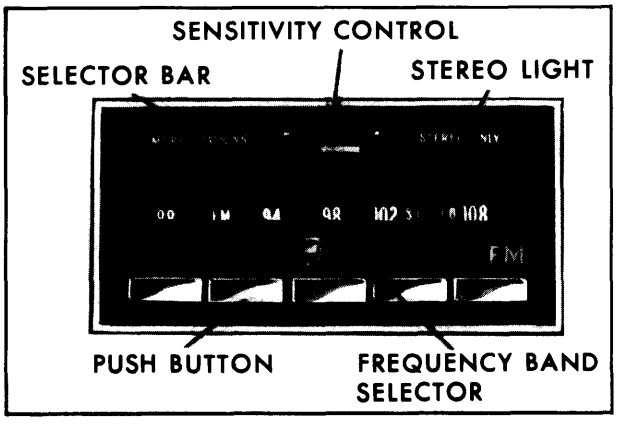


Fig. 12-40 AM/FM Stereo Signal Seeking Receiver

BACK TO INDEX

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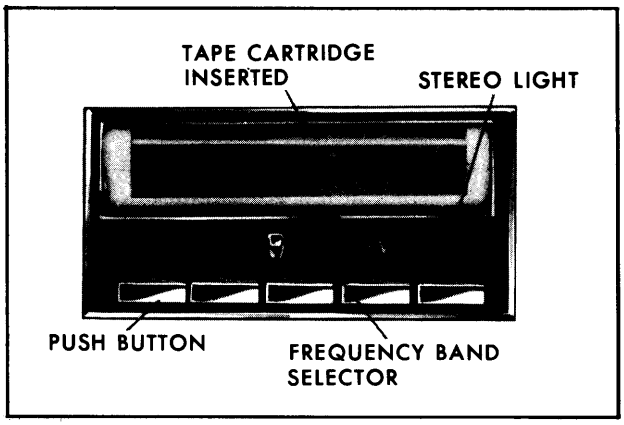


Fig. 12-41 AM/FM Stereo with Eight Track Tape

When the FM receiver moves out of range of the FM transmitter, it enters what is referred to as the fringe area. In the fringe area, the strength of the FM signal may vary rapidly, causing a flutter or a series of noise bursts as the car moves between high and low level signal points.

A second effect found in the fringe area is the presence of ignition interference from adjacent vehicles. In both instances, it may be possible to improve reception by carefully retuning; however, it may be necessary to change to a different station if reception still is not good.

Retuning should be necessary only in those few instances when reception becomes slightly noisy while driving through areas such as the center of a large city and a weak signal is being received from a station located away from the center of the city. The interference can be reduced by adjusting the tone control for more bass, and by shifting the speaker fader to favor the rear seat.

While these adjustments will slightly diminish stereo effect on cars so equipped, they will substantially reduce background noise interference.

As soon as reception clears, reset the tone control to the normal detent and again adjust the front and rear speakers for equal output.

The FM section of the AM/FM and AM/FM Stereo and AM/FM Stereo Weather Band radios is equipped with automatic frequency control, which aids tuning to a station. The FM receiver should be tuned directly on station frequency for minimum noise interference; however, the automatic frequency control will tune directly to and lock on station frequency when slight mistuning is encountered.

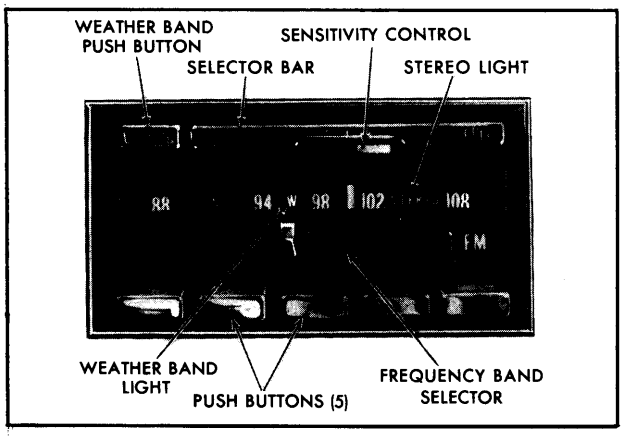


Fig. 12-42 AM/FM Stereo Signal Seeking Receiver with Weather Band

Another feature of FM tuning is increased signal selectivity. When two FM stations are close in frequency, the FM tuner selects the stronger signal, rejecting the weaker one. This is in contrast to AM performance, where it is not always possible to separate two stations.

The AM/FM radio incorporates an AM receiving circuit and an FM receiving circuit. The audio system is common to both receiving circuits.

The AM/FM Stereo and AM/FM Stereo Weather Band radio incorporates an AM receiving circuit, an FM receiving circuit, an FM stereo detection circuit, and a dual channel audio amplifier in one unit.

The signal seeking feature is provided on the AM/FM Stereo and AM/FM Stereo Weather Band radios. The AM and FM frequency band selector bar is located below the receiver dial.

All Stereo radios should always be fine tuned to assure maximum signal response and minimize unwanted noise.

To simplify tuning, only the dial for the frequency band selected is visible. The letters "AM" or "FM" on either side of the selector bar show the frequency band selected.

On stereo radios, the letters "STEREO" on the right side of the dial illuminate as shown in Fig. 12-40 when the FM station tuned is capable of transmitting stereo. The illumination of the letters "STEREO", however, does not indicate that the station is transmitting stereo at the particular moment. Stereo programs are broadcast on the FM frequency band only.

Weather Band

A pushbutton located at the left of the signal seeking selector switches the radio to the weather band and automatically tunes to the frequency (162.40 or 162.55 MH_Z) which is continuously broadcasting weather conditions in that area. When the "W" on the dial illuminates, signifying that you are within reception range, depressing the "WEATHER" pushbutton will automatically set the radio for weather band reception. Depressing the pushbutton a second time will automatically reset the radio to the original AM or FM band station.

Since most weather band broadcasting stations use low power transmitters (90 to 1000 watts) effective reception may be limited to a radius of twenty miles from the transmitter. This may also result in increased multipath reception. A few areas may also encounter station switching or "interference" with medical or industrial broadcasts being transmitted on adjacent frequencies. This must be considered normal.

Weather band stations currently in operation are primarily along the East, West and Gulf Coasts and the Great Lakes areas. A complete coast-to-coast network of stations is scheduled to be in operation as soon as 1977. Since weather band broadcasts are of an informative rather than entertainment nature, the broadcast quality should not be compared to entertainment stations.

BACK TO INDEX

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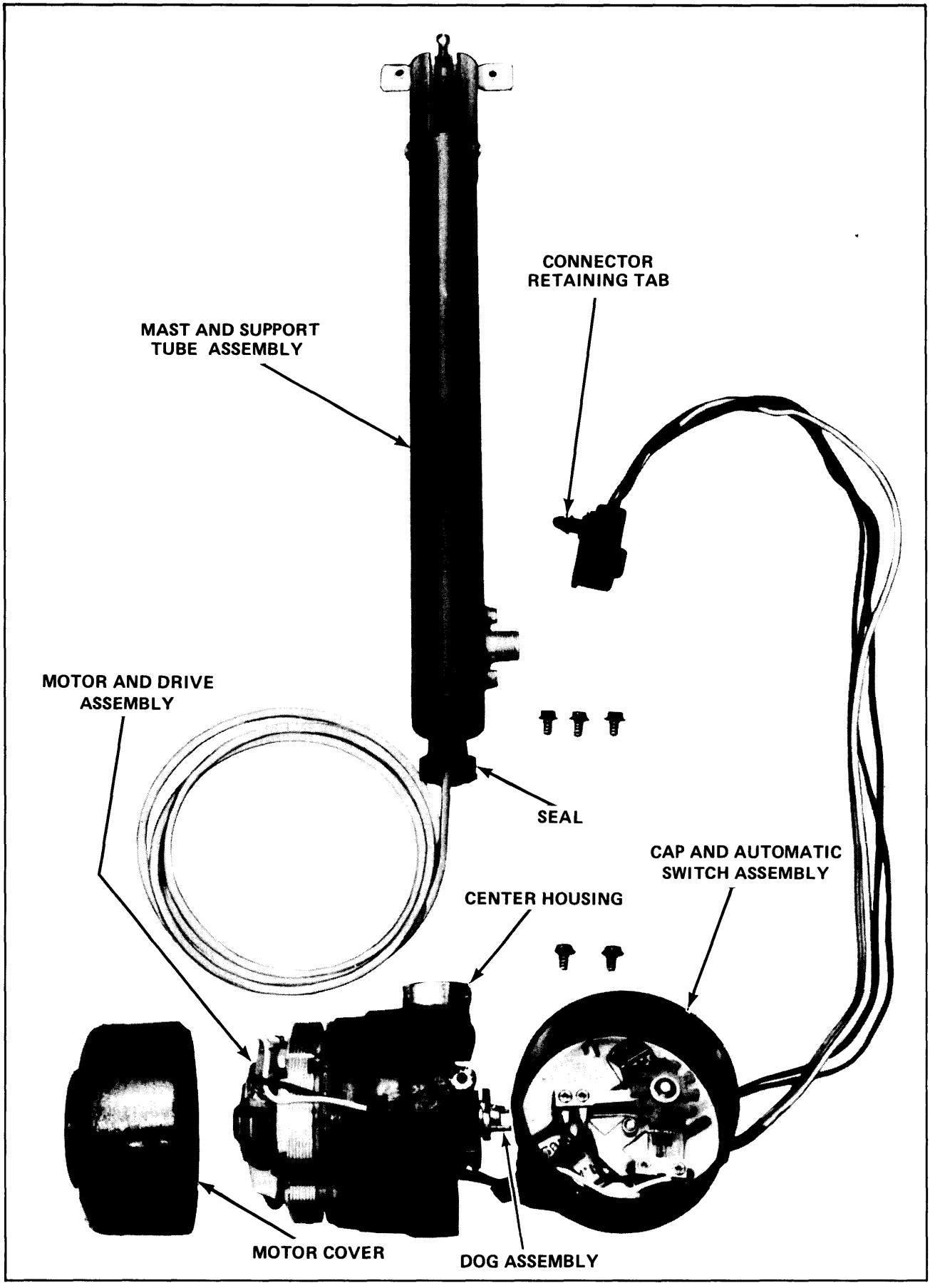


Fig. 12-43 Electric Antenna Disassembled

BACK TO INDEX

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AM/FM Stereo Radio and Eight Track Tape Player

With the AM/FM stereo radio and eight-track tape player, the owner may make his own selection of prerecorded music. To operate in the tape player mode, turn the radio on and fully insert a tape cartridge into the opening behind the face of the receiver dial. The dial face will swing up into the receiver, similar to a mail chute door, when the tape cartridge is inserted. This automatically removes power from the radio and switches control of the speakers to the tape player.

To change tape programs, momentarily depress the volume control knob. Each time the volume control knob is depressed, the tape cartridge will change to the next recorded program. To eject the tape cartridge from the engaged position, gently pull out on the volume control knob. The cartridge may be left in this ejected position without damage to the tape. With the tape cartridge ejected, power is automatically returned to the radio along with control of the speakers. To fully remove tape cartridge, pull gently out of the radio face.

Tape cartridges should be handled carefully and should be kept clean. A cartridge should not be left inserted fully in the player. This may cause permanent damage to the cartridge.

Silicone spray lubricants are specifically not recommended for switch plunger or tape head lubrication.

Signal Seeking Tuner

The signal seeking tuner provided on AM/FM Stereo and AM/FM Stereo Weather Band radios is electronically controlled so that the operator may change stations by depressing the selector bar. The signal seeking operation consists of a low to high frequency sweep (left to right) of the AM or FM broadcast band by the tuner.

When the selector bar is depressed and released, the tuner moves to the station of next higher frequency (to the right) and stops automatically at the point where that station is best received. This action takes place each time the selector bar is depressed. When the tuner has

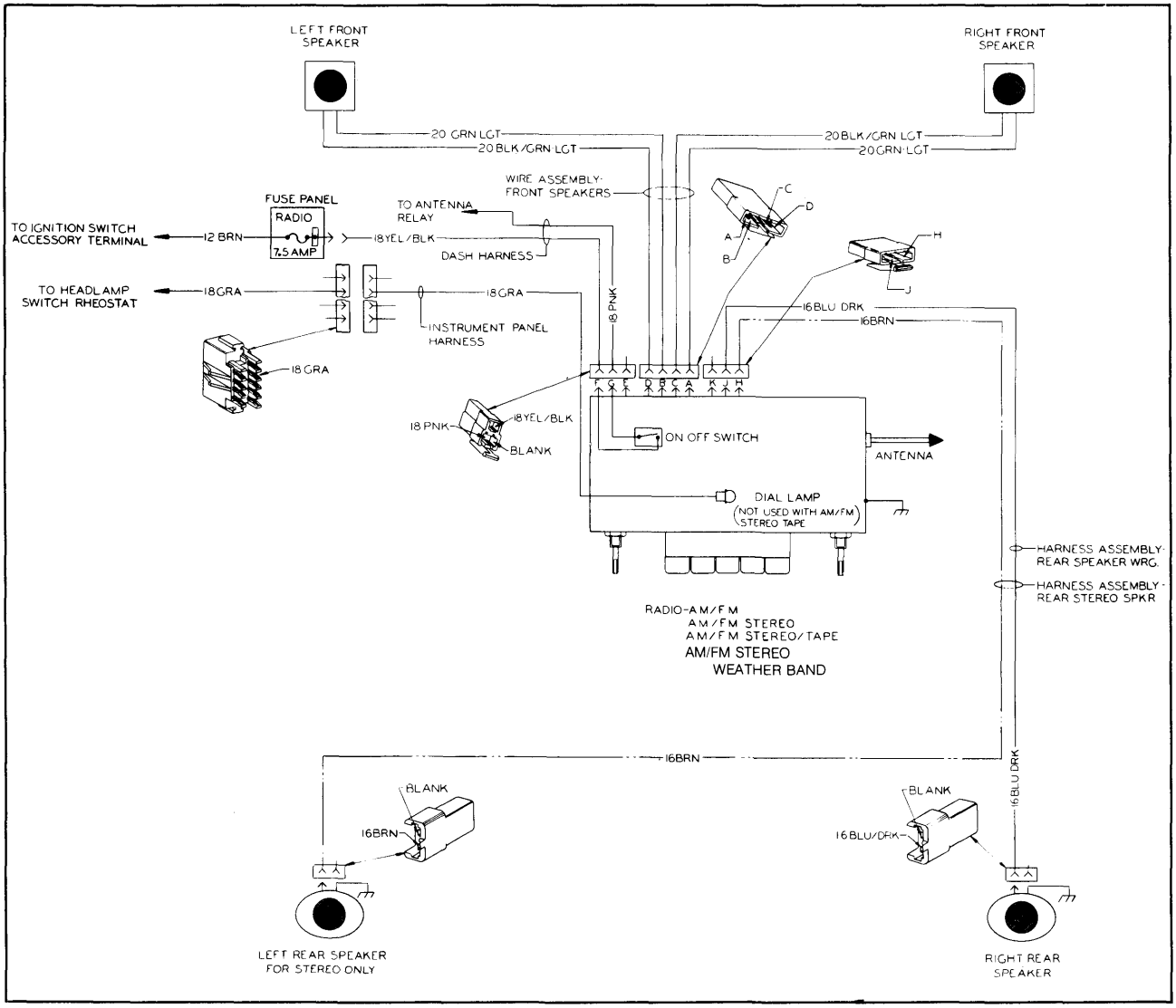


Fig. 12-45 Radio Wiring Circuit Diagram

BACK TO INDEX

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reached the point of highest frequency of the broadcast band, it returns to the low frequency (left) side of the broadcast band and begins a new sweep to the right, stopping at the first receivable station. The above procedure is then repeated when the bar is again depressed.

The stopping sensitivity of the signal seeking tuner may be varied by changing the position of the three-position sensitivity control switch located just below the center of the selector bar, Fig. 12-40. The third (right hand) position allows the signal seeking tuner to stop only on FM stereo stations when the radio is being played on the FM frequency band.

A foot control switch that performs the same station seeking functions as the station selector bar is available as a dealer installation for signal seeking radios only.

The circuit diagram for radios is illustrated in Fig. 12-45.

Internal radio schematic diagrams are shown in the Radio Service Manual.

40. Radio Controls, Operation

a. Frequency Band Selector Bar

The frequency band selector bar is located below the frequency dial. Sliding the bar to the right engages the AM band, changes the dial to the AM frequency, and illuminates the "AM" tell-tale light located at the left side of the dial. Sliding the selector bar to the left engages the FM band, changes the dial to the "FM" frequency, and illuminates the "FM" tell-tale light located at the left side of the dial. Stereo broadcasts can be received on the FM band only. When an FM stereo station is tuned, the "Stereo" tell-tale light to the right of the dial illuminates.

On the stereo radio with the tape player, the "Stereo" light is located to the right of the band selector.

b. Rear Seat Remote Control (Fleetwood Seventy-Five Styles Only)

Rear seat remote radio control is available as an option for installation in Fleetwood Seventy-Five style cars equipped with the AM/FM stereo signal seeking radio. The remote controls consist of an ON-OFF volume control, a sensitivity control, and a selector button located behind the sliding access door in the right rear quarter panel trim.

Once the appropriate AM or FM band is selected at the radio, the rear seat remote control overrides the front radio control when it is turned on and off, and controls the volume in both channels simultaneously. The three position sensitivity control is located beneath the ON-OFF volume control knob. Rotating the control clockwise when the receiver is on the AM band allows the tuner to stop only on most powerful stations, slightly lower power stations and all possible stations respectively. Rotating the control clockwise when the receiver is on the FM band allows the tuner to stop only on the most powerful stations, all possible stations, and stereo-only stations respectively.

c. Switch Volume and Tone Controls

The left knob turns the radio on and off, and controls the volume. On the stereo radio, the knob controls the volume in both channels simultaneously. The tone control ring around the left knob is turned counterclockwise for bass tones and clockwise for treble tones. When indexed at the detent, it provides a balanced normal tone. On the stereo radio, this control varies the tone in both channels simultaneously. On the radio with stereo eight-track tape player combination, momentarily depressing the volume control knob changes tape programs, with a cartridge fully inserted. Pulling gently on the volume control knob ejects the tape cartridge.

For best stereo reception, neutralize the tone control by turning it to the center detent position, then adjust the front and rear speaker control as outlined in Part d of this note so that the sound is balanced to your ears. Centering the tone control permits normal response from the speakers, and balanced speaker output is desirable for greatest stereo effect.

d. Manual Station Selector and Speaker Control

The right knob is used to tune stations manually. The ring around the knob is the speaker control. When the ring is turned all the way counterclockwise on the monaural, about 90% of the volume will be shifted to the front speakers. Turning the ring progressively clockwise will shift the speaker favor to the rear. Turning the ring to the full clockwise position shifts about 90% of the speaker volume to the rear speaker or speakers. This control has no effect on the balance of stereo channels.

e. Push Button Tuning (AM/FM, AM/FM Stereo or AM/FM Stereo Weather Band Radios)

Each one of the five push buttons may be preset to a favorite AM station when on the AM band. Each one of these same five push buttons may be set to a favorite FM or stereo station when on the FM band. This makes a total of ten pre-set favorite stations. To preset push buttons on AM stations, proceed as follows:

Slide frequency band selector bar to the right to engage the AM band. Manually fine tune to favorite AM station. Pull push button straight out to unlatch then push in all the way to relatch. Push button is now set to desired station. Whenever this push button is depressed, the preset station will be selected. Set additional push buttons to AM stations as desired.

To preset push buttons to FM and FM stereo stations, proceed as follows:

Slide frequency band selector bar to the left to engage the FM band. Manually fine tune to favorite FM or stereo station. Pull push button straight out to unlatch. Then push in all the way to relatch. Push button is now set to desired FM or Stereo station. Whenever this push button is depressed, the preset station will be selected. Set additional push buttons to FM or stereo stations as desired.

CAUTION: Do not remove the AM-FM slide bar band selector while any push button is pulled out. Damage to tuner mechanism may result.

BACK TO INDEX

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f. Automatic Tuning (Signal Seeking Radios Only)

To use automatic tuning, depress the selector bar above the dial momentarily. Any station within range of the receiver and determined by the sensitivity control switch setting, can be obtained by holding the bar depressed until the dial pointer approaches the desired frequency, and then releasing the bar. The automatic tuner will seek immediately when the selector bar is depressed.

g. Sensitivity Control (Signal Seeking Radios Only)

A three-position sensitivity control switch for automatic tuning is located below the center of the selector bar. On the AM band, moving the switch to the left allows the tuner to stop only on most powerful stations. In the middle position, stations of slightly lower power will be received in addition to stronger stations. To obtain maximum sensitivity, and bring in all possible stations, move switch to the right.

On the FM band, the left and center switch positions allow the tuner to stop only on most powerful stations and all possible stations respectively.

When the switch is in the right hand position, the tuner will stop only on FM stereo stations.

On Fleetwood Seventy-Five series cars, when the rear seat remote radio controls are on, the red selector button is illuminated. Depressing this button performs the same function as pressing the selector bar. With the rear seat radio control ON, the driver may reduce or increase the volume of the front speakers with the ring behind the right control knob, tune the radio manually or with the push buttons, and change the frequency bands. With the ring around the left control knob, he may vary the tone in both channels simultaneously. With remote control turned OFF, all front controls will operate normally.

41. Radio Noise Suppressors

a. Ignition Suppressors

Various types of ignition suppressors are used to prevent ignition noise from interfering with radio reception. Failure of any of these parts to function properly is accompanied by a popping noise. The noise increases as the engine is accelerated, and varies with engine speed. If this interference is present, check the following suppressors:

1. Ignition noise is suppressed by use of resistance core ignition cables. Check for high resistance in cables. The resistance of these cables is 2,000 to 6,000 ohms per foot.
2. Make certain resistance spark plugs are being used to minimize igntion noise.
3. On all but Eldorados, check ground cable from negative battery cable at frame to radiator cradle.
4. On Eldorados, check ground cable between transmission housing and cowl.
5. It is particularly important that the terminals in the ignition secondary cables make good mechanical contact with the spark plug terminals and HEI cap terminals. A loose connection at these points will result in excessive ignition noise, seriously reducing FM performance.
6. A capacitor mounted on the inside of the HEI unit may be checked by running engine at medium speed and then quickly turning ignition switch to the Accessory position. If the noise is eliminated, while the engine is coasting to a stop, replace capacitor. This check applies to FM reception only.

b. Antenna Motor Electrical Noise

Excessive antenna motor electrical noise is often caused by the antenna lead-in cable ferrule at the antenna mast not being properly installed. This condition can be corrected by removing, cleaning if necessary, and then reconnecting the antenna lead-in cable, and tightening retaining nut.

c. Blower Motor Capacitor

A capacitor is mounted on the blower motor assembly for suppressing radio noise at high blower speeds. If the whine is eliminated when the Automatic Climate Control or heater is turned from high to a lower blower setting, this capacitor should be replaced.

d. Generator Capacitor

A 1.5 mtd. capacitor is mounted inside the generator to suppress generator whine. Turn Climate Control off and if radio whine is speed sensitive, replace capacitor.

42. Diagnosis Procedures

Many conditions that affect radio operation may be corrected without removing set from car. Check condition and using diagnosis chart at front of this Section perform the operation or operations necessary to correct the condition. If these minor repairs are not effective, radio should be removed from car and repaired at an authorized radio service station.

CAUTION: Do not turn on radio with any speaker disconnected, as an audio fusistor may be damaged.

a. Fuse

A thump should be heard from the speakers when the radio is turned on. If thump is not heard, check 7.5 amp. fuse and replace with one of the same amperage. If fuse blows the second time on non-signal seeking receiver or signal seeking and return operation, the radio should be sent out for repairs.

b. Battery

Check battery and make sure that it is fully charged. If attempting to diagnose problems with the engine off, batteries supplying less than 9 volts will cause erroneous diagnosis of AM and FM problems.

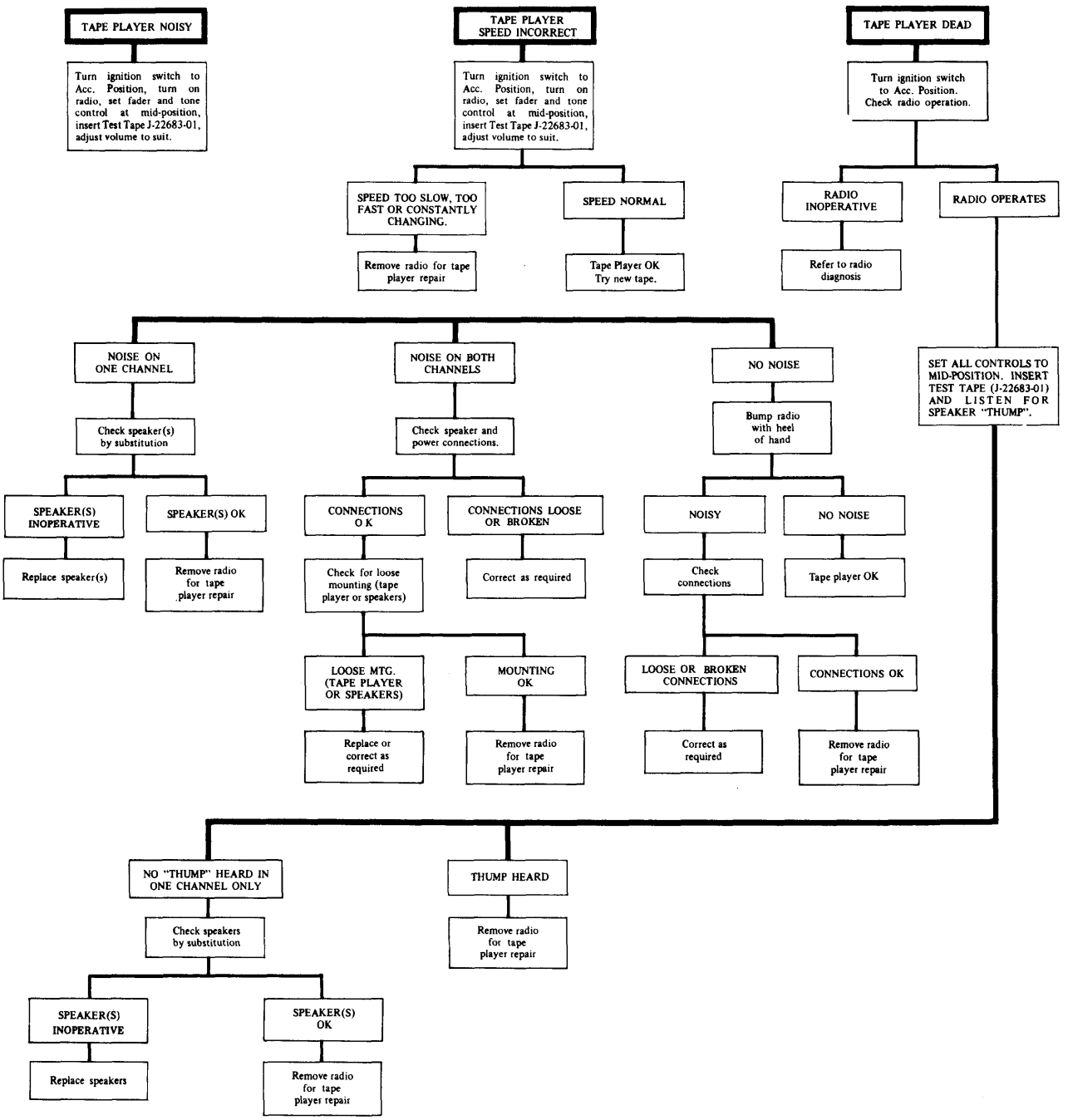
c. Speaker Connections

Check speaker leads for possible open circuit or ground. There are four speakers with stereo installations, three with monaural radios.

BACK TO INDEX

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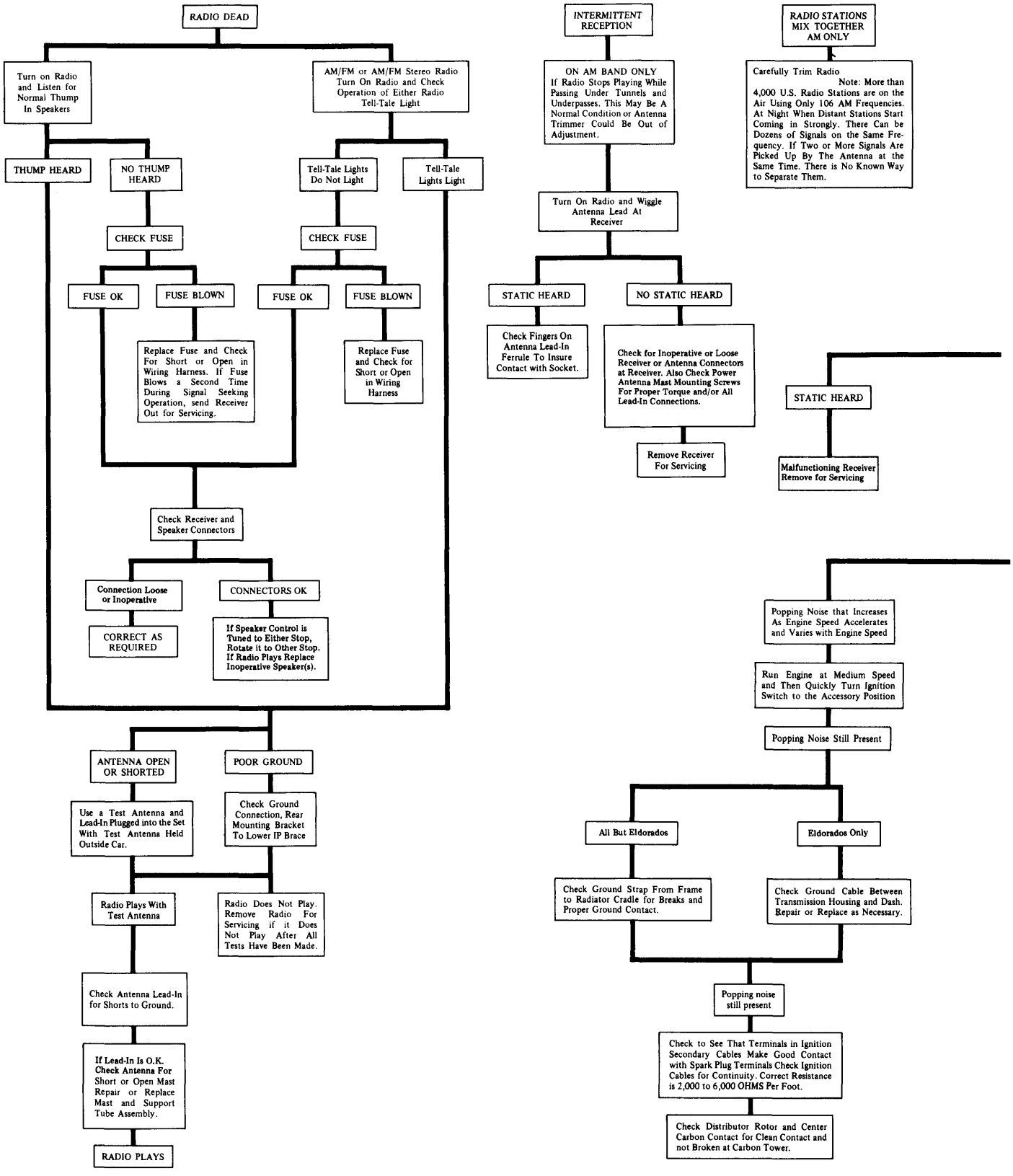
INTEGRAL STEREO EIGHT TRACK TAPE PLAYER DIAGNOSIS



BACK TO INDEX

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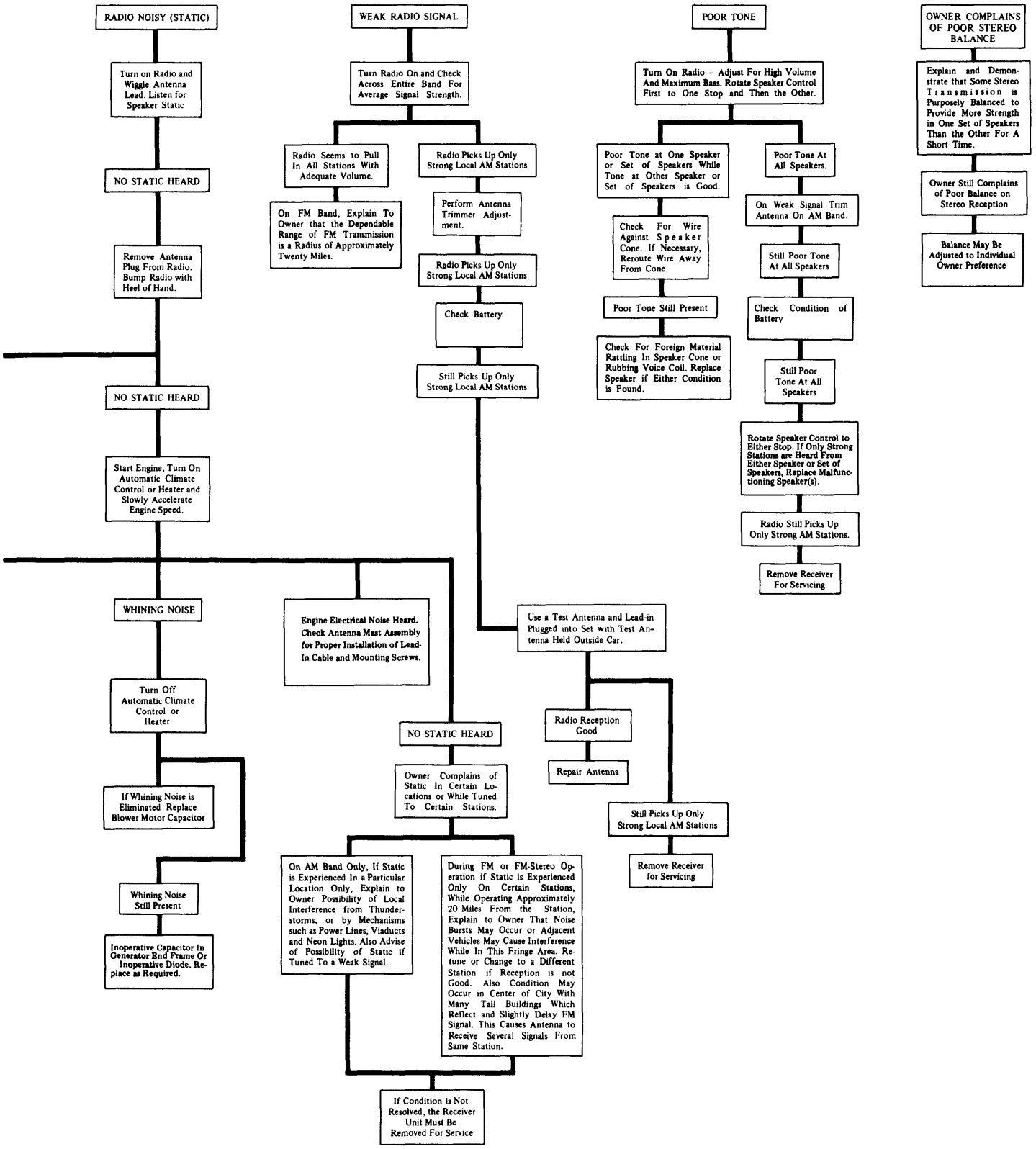
RADIO DIAGNOSIS CHART



BACK TO INDEX

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RADIO DIAGNOSIS CHART



BACK TO INDEX

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ELECTRIC ANTENNA DIAGNOSIS

Condition	Cause	Correction
Antenna does not operate when ignition and radio switches are turned "ON".	Open 7 1/2 AMP radio fuse Open 20 AMP antenna fuse Antenna relay disconnected Antenna wiring connector (4 way) disconnected Antenna relay mounting loose or not grounded to cowl Antenna not grounded (open) at fender mount Radio power connector disconnected Relay power wire (orange wire) disconnected at harness Relay inoperative (click should be audible when radio switch is turned "OFF") By-passed up/down limit switch Antenna motor inoperative	Replace 7 1/2 AMP radio fuse in fuse block Replace 20 AMP antenna fuse in fuse block Connect wiring connectors to relay (on cowl) Connect (4 way) antenna wiring connector to harness connector Tighten relay mounting screws to secure proper ground Remount antenna to fender to secure proper ground Connect power connector to radio receiver Connect relay (orange wire) to harness connector Replace relay Replace cap and automatic switch assembly (on antenna) Replace motor and drive assembly
Antenna operates automatically to 12" and down into fender, but cannot be operated to full height by antenna manual switch.	Antenna manual switch disconnected or inoperative Antenna manual switch does not make contact in "UP" position Red wire disconnected at (4 way) connector 12" limit switch does not close (check for power at red wire at 4 way connector with non powered test light)	Connect manual switch connector to harness connector Replace antenna manual switch (in Instrument Panel) as assembly Connect red wire to (4 way) wiring connector and secure connector Replace cap and automatic switch assembly (on antenna)
Antenna operates automatically up to 12", down into fender, and manually to full height, but cannot be operated downward by manual switch.	Manual antenna switch white wire open Manual antenna switch does not make contact in "Down" position	Repair white wire as necessary Check for loose connection. If secure, replace antenna switch assembly
Motor runs but antenna does not move; or only moves short distance up or down.	Drive cable slipping at engagement point inside motor housing Drive disconnected from mast Stripped drive gears inside motor housing Slipping clutch inside motor housing	Replace motor and drive assembly Replace mast and support tube assembly Replace motor and drive assembly Replace motor and drive assembly
Motor continues to run without stopping after ignition switch is turned "OFF" and mast has secured into fender (one to five clutch clicks are normal after antenna has lowered into fender before motor stops).	Inoperative or by-passed "Down" limit switch	Replace cap and automatic switch assembly (on antenna)
With ignition and radio switches "ON", antenna extends to full height (34") before motor stops.	Inoperative or by-passed 12" limit switch	Replace cap and automatic switch assembly (on antenna)

BACK TO INDEX

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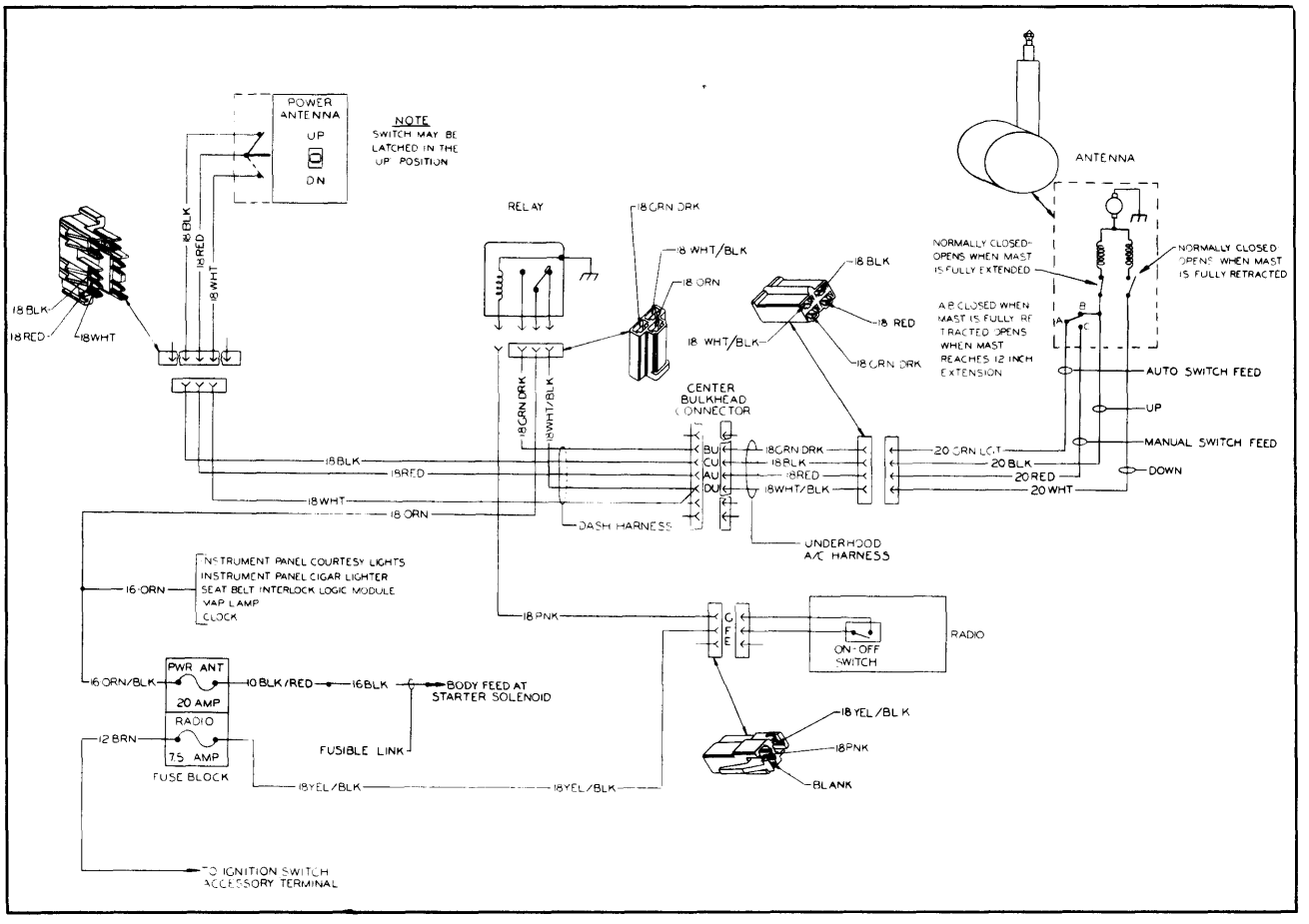


Fig. 12-46 Electric Antenna Wiring Circuit Diagram

d. Electric Antenna

Use a test antenna and lead-in plugged into the set with test antenna held outside car. If radio works satisfactorily with this test assembly, car antenna should be checked for a short or ground, and lead-in should be checked for continuity. Test antenna mast for shorts to ground while wiggling antenna.

If a ground is indicated in this test, disassemble antenna and check for poor insulators or presence of water or moisture in body tube. Test with volt-ohm meter from end of either lead-in tip to ground. If lead-in test shows a ground, replace lead-in.

The conditions mentioned above will cause a weak or intermittent signal and will cause signal seeker if so equipped, to sweep back and forth across the dial when tuning bar is depressed while car is in an unusually weak signal area, such as in a building or under a viaduct.

Do not remove the set to correct this condition until all previous checks on the antenna have been made with the car in a fairly strong signal area.

e. Antenna Will Not Raise or Lower

This condition can be due to an open fuse, loose electrical connections at the switch on the receiver unit or at the antenna motor, a bent antenna mast, or a malfunctioning relay. If a check of these causes fails to correct the condition, disassemble the antenna and replace any inoperative parts.

f. Antenna Switch Test

1. Remove accessory switch panel as described in Note 88a.

2. Disconnect electrical feed wires from wiring harness.

3. Touch one lead of self-powered test light to red wire and other lead to black wire. Test light should light when switch is held in "up" position, Fig. 12-46.

4. Remove test light lead from black wire and touch to white wire. Test light should not light when switch is held in "down" position, Fig. 12-46.

5. If switch performs as above, remove test light and reinstall switch. If not, replace antenna switch.

BACK TO INDEX

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SERVICE INFORMATION

43. Minor Adjustments

a. Antenna Trimmer Adjustment (Fig. 12-47)

(NOTE: If antenna is not trimmed, the set will have weak and fading AM reception. Antenna trimming should always be performed after any radio or antenna repair work, or antenna replacement is completed.)

1. Turn radio on. Switch to AM band.
2. Use manual antenna switch and extend mast to full up position.
3. Tune in a weak station at approximately 1400 Kilohertz on the AM band and turn volume control to maximum.
4. Adjust antenna trimmer, located behind right control knob ring, for maximum volume. Access to antenna trimmer is gained by removing right control knob, spring and ring use a standard 1/8" screwdriver to adjust the screw, Fig. 12-47.

(NOTE: If during adjustment, the station becomes strong so that a change in volume cannot be heard with further screw rotating, tune to a weaker station and continue the adjustment.)

b. Balance Adjustment (Fig. 12-48) (AM/FM Stereo Models Only)

If the sound appears to be louder on one side of the car than the other, an adjustment to the audio balance may be made.

(NOTE: On some stereo programming, it is normal for one side to be louder than the other for a short time. This is done purposely for stereo effect. The only positive method to tell if the balance control needs adjustment is to tune in a non-stereo program and make a critical evaluation, in which the owner may assist.)

If the adjustment is needed proceed as follows:

1. Turn radio on. Switch to AM band.
2. Remove left knob, spring and control ring to gain access to stereo balance screw.
3. With fader control turned fully clockwise, insert screwdriver into balance screw, Fig. 12-48.
4. Rotate balance control adjustment clockwise or counterclockwise until the sound in the left and right speakers appear to have equal volume.
5. Install left control ring, spring and knob.

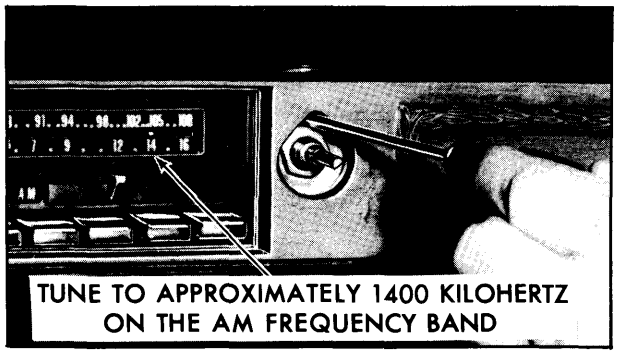


Fig. 12-47 Antenna Trimming Adjustment

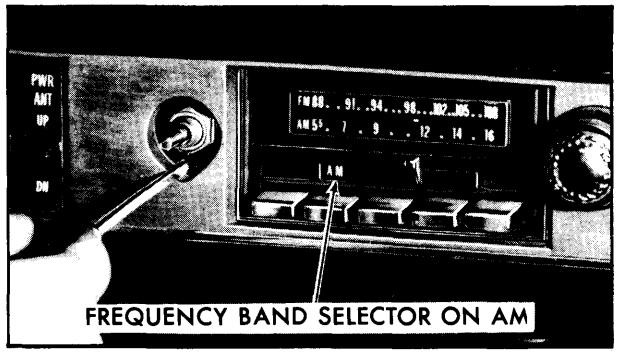


Fig. 12-48 Stereo Speaker Balance Adjustment

44. Stereo Tape

The only required maintenance on tape players is periodic cleaning of the tape player head. This service should be performed approximately every 100 hours of operation. The head cleaning is done by swabbing the head (unit still installed in car) with a cotton swab that has been dipped in rubbing alchol.

No lubricants should be used since they will cause the player to operate improperly, especially at extreme temperature.

Do not bring any magnetized tools near the tape head. If the head becomes magnetized, every cartridge played in the player will be degraded.

A test tape cartridge, Fig. 12-49, is available for diagnosing problems in tape players. The "Stereo 8" test tape cartridge is part #J-22683. (Test tape cartridges should always be stored in a container to keep the tape clean.)

45. Radio Receiver Unit

The procedure for removing and installing the radio receiver unit is described in Note 81.

46. Radio Front Speaker

The procedure for removing and installing the radio front speakers is described in Note 82.

47. Radio Rear Seat Speaker—Except Convertible

a. Removal

(NOTE: Access to rear speaker is gained through trunk compartment.)

1. Remove 3 retainers which secure speaker baffle.
2. Disconnect speaker lead from connector at rear of speaker. This is a brown wire on the AM/FM Stereo left rear speaker and a dark blue wire on all right rear speakers.
3. Remove four nuts securing speaker to rear filler panel and remove speaker.

BACK TO INDEX

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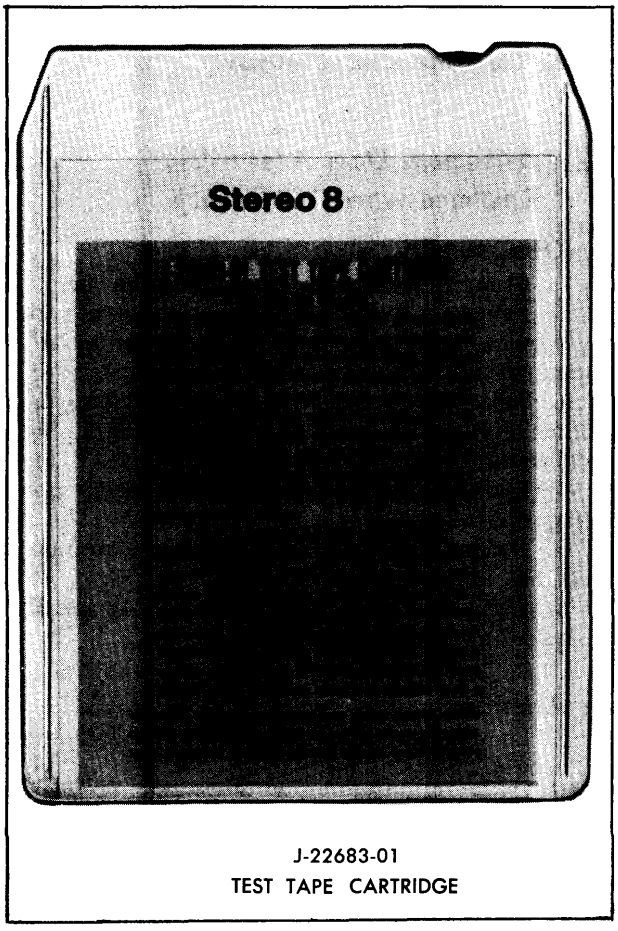


Fig. 12-49 Test Tape Cartridge Tool J-22683-01

b. Installation

1. Install speaker to rear filler panel and tighten four attaching nuts evenly to a maximum of 12 inch-pounds to prevent speaker distortion.
2. Connect speaker lead to connector at rear of speaker. This is a brown wire on the AM/FM Stereo left rear speaker and a dark blue wire on all right rear speakers.
3. Install speaker baffle and secure with 3 retainers.

48. Radio Rear Seat Speaker—Convertible Only

a. Removal

1. Remove two screws securing rear monitor readout to back of rear seat and remove readout.
2. Remove rear seat cushion and seat back.
3. Disconnect speaker wiring connector from speaker.
4. Remove four nuts securing speaker to speaker grille mounting studs and remove speaker assembly.

b. Installation

1. Position speaker on grille mounting studs and secure with four nuts.
2. Connect speaker wiring connector to speaker.
3. Install rear seat back and seat cushion.
4. Position rear monitor readout to back of rear seat and secure with two screws.

49. Rear Seat Remote Control Unit (Fleetwood Seventy-Five Styles Only)

a. Removal

1. Remove rear seat cushion by pushing rearward and lifting forward edge of cushion, then pull forward.
2. Remove rear seat back by removing two screws along lower edge of back and lifting assembly off mounting hooks.
3. Remove five screws securing right quarter window garnish molding and remove molding.
4. Remove six screws retaining right arm rest assembly.
5. Remove right front and rear door sill plates.
6. Remove right front kickpad.
7. Peel back carpet to gain access to remote cable along right sill, and remove securing tape.
8. Remove instrument panel top cover as described in Note 60a.
9. Disconnect cable assemblies at rear of radio.
10. Remove one screw and bend two clips out of way and remove cable from shroud vent duct and hinge pillar areas.
11. Thread cable through harness conduit in rear partition.
12. Loosen set screw in knob assembly and remove know assembly, felt washers, and sensitivity ring.
13. While holding control and cable assembly in one hand, remove jamb nut securing assembly to escutcheon.
14. Route cable out of right rear quarter trim panel assembly.

b. Installation

1. Thread plug end of cable forward through hole in line with harness conduit in rear partition.
2. Route cable to radio through hinge pillar area and along shroud vent duct.
3. Connect cable assemblies at left rear corner of radio.
4. Route cable along instrument panel and install in wiring conduit. Secure with one screw and two clips.
5. Secure control and cable assembly to escutcheon with jamb nut.
6. Install sensitivity ring, felt washer, and knob assembly and tighten set screw in knob assembly.
7. Turn on radio and test for operation. Extend antenna fully and peak antenna trimmer on weak station at approximately 1400 Kilohertz on AM band, as described in Note 43a.
8. Install right front kickpad.
9. Install carpet and right front and rear door sill plates.
10. Install instrument panel top cover as described in Note 60b.
11. Install right armrest assembly with six attaching screws.

BACK TO INDEX

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12. Install right quarter window garnish molding and secure with five screws.
13. Install rear seat back on mounting hooks and secure with two attaching screws.
14. Install rear seat cushion.

50. Antenna Manual Switch Removal and Installation

The procedure for removing and installing the accessory switch panel is described in Note 88.

51. Antenna Unit (Fig. 12-50)

a. Removal

1. Lower antenna.
2. Disconnect negative battery cable at battery.
3. Disconnect electrical connector and antenna lead-in cable from support tube.
4. Remove two screws which secure upper antenna mounting bracket to fender.
5. Remove bolt and washers securing antenna to right fender antenna mounting bracket and grommet and remove antenna and splash shield from car.
6. Escutcheon may be removed by depressing lock tabs and pushing escutcheon out through top of fender.

b. Installation

1. Install escutcheon.
2. Install antenna in position.
3. Install splash shield, bolt and washers securing antenna assembly to right fender antenna mounting bracket.
4. Install two screws securing upper antenna mounting bracket to fender. Tighten to 30 inch pounds.
5. Connect lead-in cable to support tube. Tighten nut to 65 inch pounds.
6. Connect electrical connector.

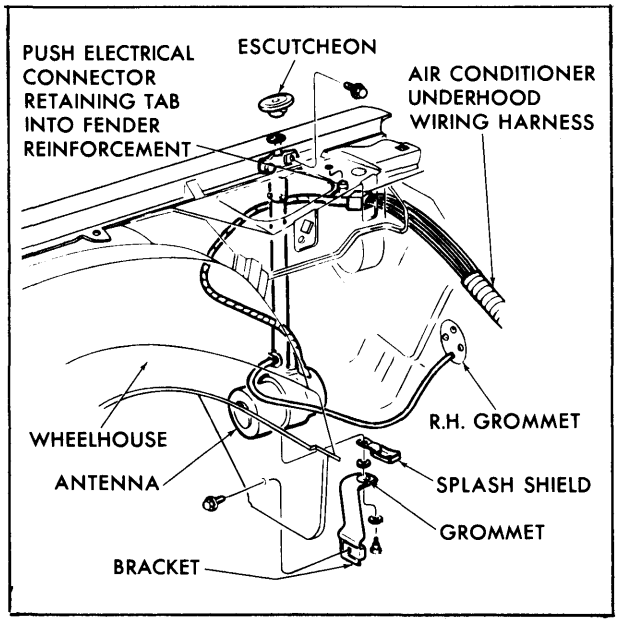


Fig. 12-50 Electric Antenna Installation

7. Connect negative battery cable and tighten to 70 inch pounds.
8. Check operation of antenna.

52. Antenna Dog Assembly Replacement (Off Car)

a. Disassembly

1. Clamp antenna lower mounting boss in vise.
2. Remove 2 screws which secure automatic switch and cover assembly to drive housing. Cut sealer at housing-to-cover joint.
3. Separate switch and cover assembly from drive housing. Pry with screwdriver as shown in Fig. 12-51 to avoid cracking center housing ears.
4. Rock dog assembly gently with pliers as shown in Fig. 12-51a to loosen pin.
5. Remove pin securing dog assembly in position to shaft, Fig. 12-51b.
6. Using open end wrench, remove dog assembly from shaft by turning dog counterclockwise.

b. Assembly

1. Loosely install dog assembly on shaft by turning in clockwise direction.
2. Using template provided, measure distance between top of pin on dog to case of drive housing, Fig. 12-52. Adjust as necessary.
3. Final position of dog assembly MUST be parallel with beam as shown in Fig. 12-52. If in final gaging dog is not parallel with beam, turn dog counterclockwise until it is.
4. Install pin which secures dog to shaft, Fig. 12-51b.

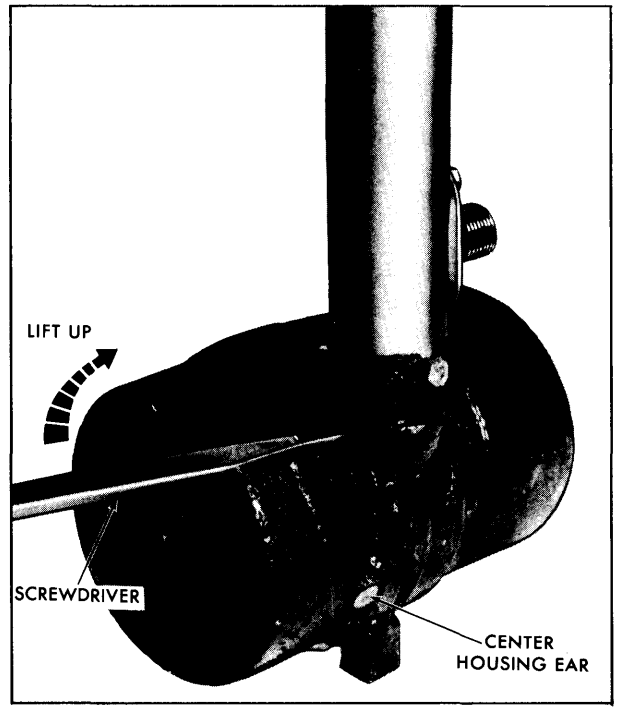


Fig. 12-51 Separating Cap From Antenna Housing

BACK TO INDEX

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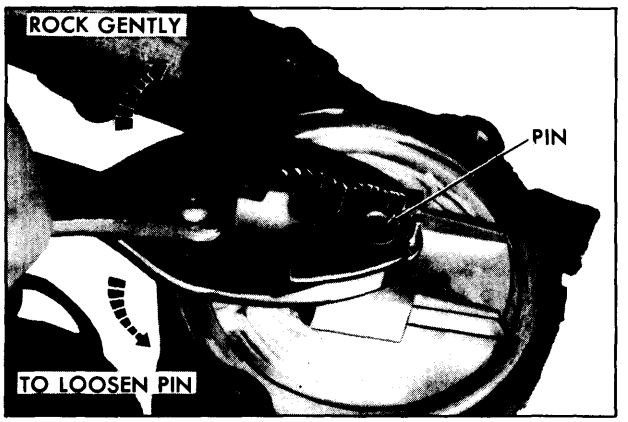


Fig. 12-51a Loosening Antenna Dog Pin

5. Position automatic switch and cover assembly to drive housing and secure with 2 screws.
6. Remove antenna assembly from vise and reseal joint using care to be certain drain holes remain open.

53. Antenna Cap and Automatic Switch Assembly Replacement (Off-Car)

a. Disassembly

1. Clamp antenna lower mounting boss is vise.
2. Untape antenna wiring harness from support tube.
3. Remove 2 screws which secure automatic switch and cover assembly to drive housing. Cut sealer at housing-to-cover joint.
4. Separate switch and cover assembly from drive housing, Fig. 12-51.
5. Stagger cut black and white wires midway between motor and switch assembly and discard switch.

b. Assembly

1. Strip approximately 3/16" of insulation off black and white wires from both motor and switch leads.
2. Join leads together (black to black and white to white) and solder securely.

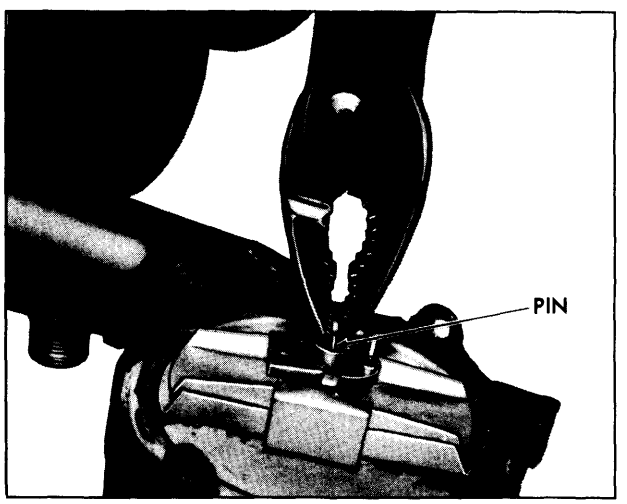


Fig. 12-51b Removing Antenna Dog Pin

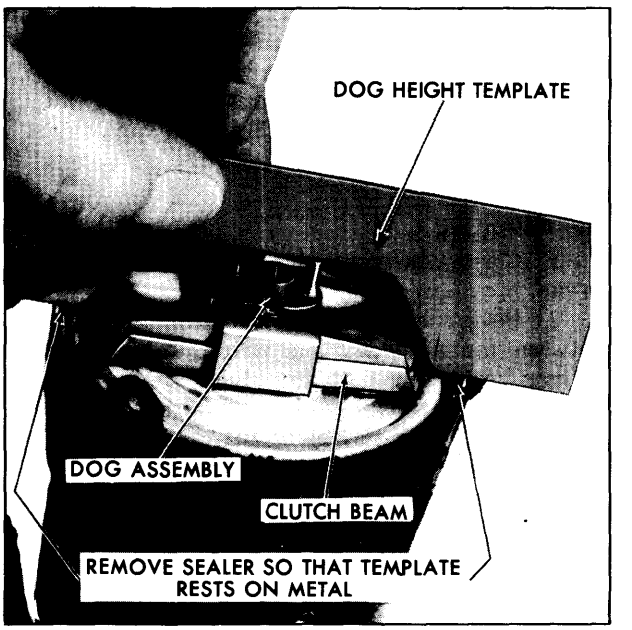


Fig. 12-52 Adjusting Dog Height and Position

3. Tape solder joints with electrical tape.
4. Position automatic switch and cover assembly to drive housing and secure with 2 screws.
5. Tape antenna wiring harness to support tube.
6. Remove antenna assembly from vise and reseal joint using care to be certain drain holes remain open.

54. Antenna Motor and Drive Assembly Replacement (Off Car)

a. Disassembly

1. Remove dog assembly from shaft as described in Note 52a.
2. Stagger cut black and white wires midway between motor and switch assembly.

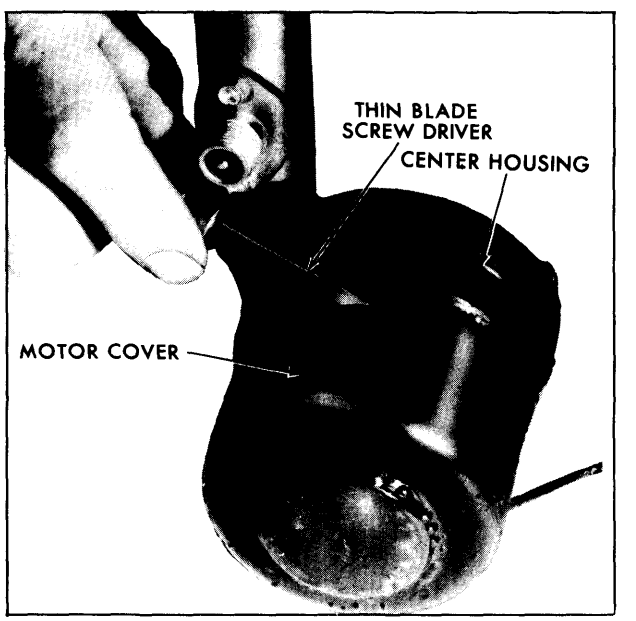


Fig. 12-52a Removing Antenna Motor Cap

BACK TO INDEX

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3. Remove three screws securing support tube assembly to drive housing and pull support tube and drive cable completely out of drive housing.
4. Remove motor and drive assembly from vise.
5. Cut sealer and use a thin bladed screw driver to remove motor cap, Fig. 12-52a.

b. Assembly

1. Clamp new motor and drive unit mounting boss in vise.
2. Using template provided, measure distance between top of longest pin on dog to case of drive housing. Adjust as necessary. Final adjustment must place dog parallel with beam as shown in Fig. 12-52. If dog is not parallel turn dog counterclockwise until it is.
3. Install pin which prevents dog from turning on shaft.
4. Strip approximately 3/16" of insulation off black and white wires from both motor and switch leads.
5. Join leads together (black to black and white to white) and solder securely.
6. Tape solder joints with electrical tape.
7. Position automatic switch and cover assembly to drive housing and secure with 2 screws.
8. Apply 12 volts to black wire in four way connector while grounding antenna and run antenna to full up position.
9. Add small amount of lithium grease to cable and insert end of drive cable into drive housing and push in as far as possible to start cable.
10. With antenna grounded, apply 12 volts to white wire in four way connector and run antenna all the way down, guiding cable and mast while retracting.
11. Position support tube assembly to drive housing and secure with three screws.
12. To adjust cable for height, run antenna up until it stops; then down as outlined in Steps 7 and 9.
13. Reseal open joints using care to be certain drain holes remain open.

55. Antenna Mast and Support Tube Assembly Replacement (Off Car)

a. Disassembly

1. Clamp antenna lower mounting boss in vise.
2. Untape antenna wiring harness from support tube.
3. Apply 12 volts to black wire in four way connector while grounding antenna and run antenna to full up position.
4. Remove three screws securing support tube assembly to drive housing and pull support tube and drive cable completely out of drive housing.

(NOTE: If cable cannot be pulled out by hand, remove antenna dog as outlined in Note 52a.)

b. Assembly

1. Add small amount of lithium grease to cable and insert end of drive cable into drive housing and push in as far as possible to start cable.
2. With antenna grounded, apply 12 volts to white wire in four way connector and run antenna all the way down, guiding cable and mast while retracting.
3. Position support tube assembly to drive housing and secure with three screws.
4. To adjust cable for height, run antenna up until it stops; then down as outlined in Disassembly Step 3 and Assembly Step 2.
5. Reseal open joint using care to be certain drain holes remain open.

56. Electric Antenna Unit Maintenance and Repair Procedure

Many antenna troubles can be prevented by cleaning and lightly oiling the antenna rod at periodic intervals. Cleaning is easily performed at oil change intervals, or when a car is being washed, by wiping the rod with a soft cloth.

(NOTE: If car has been undercoated, check to make sure that drain holes have not been plugged.)

If the antenna has been disassembled for service reseal all areas at which the sealer was disturbed to prevent the entry of moisture.

a. Moisture in Cylinder

Weak reception or fading may be caused by moisture in the support tube, due to condensation or leakage through the insulation bushings. If trouble has been traced to moisture in the tube, the antenna must be removed, disassembled and the drive housing should be cleaned or replaced. Always reseal motor, drive and lower mast after servicing antenna. The splash shield is important in preventing road splash from entering the lower drain holes. Before installing antenna, check drain holes in motor lower housing and below support tube mounting point to be sure they are not obstructed.

BACK TO INDEX

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INSTRUMENT PANEL

GENERAL INFORMATION

(NOTE: Service procedures for component parts of the optional Air Cushion Restraint System are described in detail in the Air Cushion Restraint System Manual. Service procedures that are different due to the Air Cushion Restraint System option are described in the latter part of this section.)

The instrument panel for all cars is shown in Fig. 12-53. The five major parts of the panel are the top cover, instrument panel pad, horizontal support, lower instrument panel cover and lower steering column cover. This section includes procedures for the removal and installation of all components that are a part of or attached to the above major parts. Included are the following:

Top Cover – Radio speakers, speakers and defroster grilles, twilight sentinel photocell, climate control sensor, fuel gage, digital clock, tell tale housing assembly and extensions.

Instrument Panel Pad – Windshield wiper switch, climate control outlets, doors and ducts.

Horizontal Support – Cluster assembly and bezel, left and right inserts and appliques, headlamp or guidematic or twilight sentinel switch, air conditioning control, cruise control switch, accessory switches (sunroof, power antenna, rear window defogger and convertible top), radio receiver, track master controller, theft deterent controller, rear window defogger relay, control for right hand mirror and map light.

Lower Instrument Panel Cover – Ashtray and lighter, glove box assembly and power trunk release switch.

Lower Steering Column Cover (Reinforcement) – Twilight sentinel amplifier and turn signal flasher.

The procedures for actual disassembly, assembly testing, or adjustment of the various components are covered in the specific sections of this manual where they apply. A full color Chassis Wiring Circuit diagram is located on the rear cover gatefold.

The instrument panel utilizes printed circuits in both the cluster and tell tale assemblies. They are connected to the wiring harness through multiple terminal connectors which are plugged into the back of the cluster and underside of the tell tale assembly. The printed circuit permits removal of all bulbs and sockets without removing of any wire or terminal.

SERVICE INFORMATION

57. Climate Control Air Outlet Grilles (Fig. 12-54)

a. Removal

1. Using Remover and Installer Tool, J-24612, compress release tabs.
2. Rotate grille upward and remove grille.

b. Installation

1. Using Remover and Installer Tool, J-24612 compress release tabs and position grille as shown in Fig. 12-54.
2. Remove tool and position grille so that tabs snap into retaining holes.

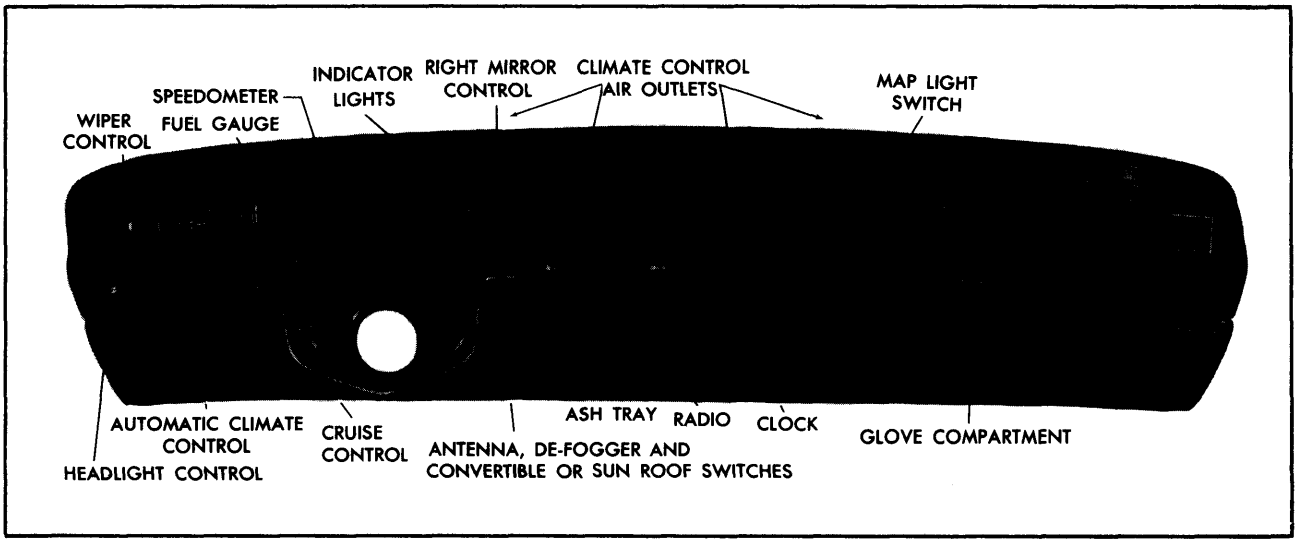


Fig. 12-53 Instrument Panel Assembly

BACK TO INDEX

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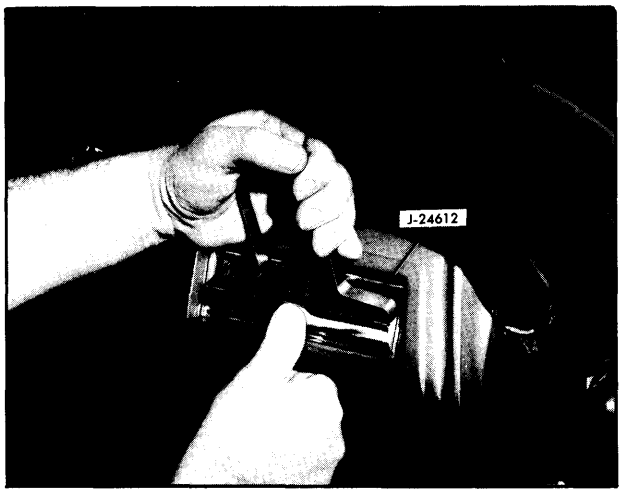


Fig. 12-54 Removing Climate Control Air Outlet Grille

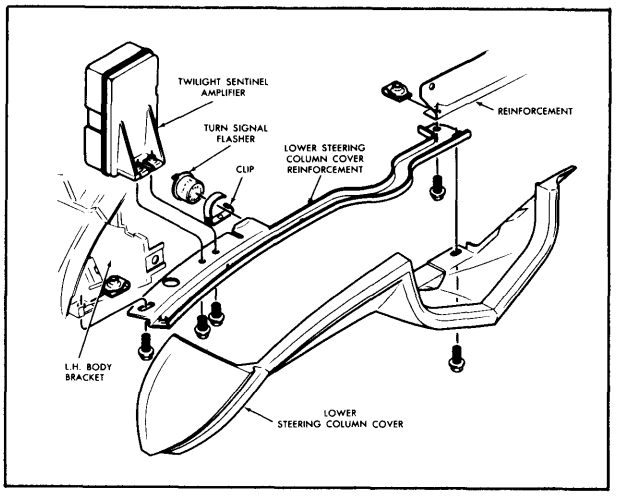


Fig. 12-55 Lower Steering Column Cover

58. Lower Steering Column Cover (Fig. 12-55)

a. Removal

1. Remove four screws securing lower cover to lower steering column cover reinforcement.
2. Remove four screws securing lower cover to instrument panel horizontal support.
3. Remove lower cover.

b. Installation

1. Place lower cover in position and install four screws securing cover to instrument panel horizontal support.
2. Install four screws securing lower cover to lower steering column cover reinforcement.

59. Instrument Panel Pad (Fig. 12-56)

a. Removal

1. Disconnect negative battery cable.
2. Remove three climate control outlet grilles – right, left and right center – as described in Note 57a.
3. Working through outlet openings, remove 3 fasteners securing pad to instrument panel support.
4. Remove 4 screws securing pad to instrument panel horizontal support.
5. Pull pad outward and disconnect electrical connector from windshield wiper switch.
6. Remove pad.

(NOTE: To facilitate removal or installation, place shift lever in lo range and on cars equipped with tilt wheel, place wheel in lowest position.)

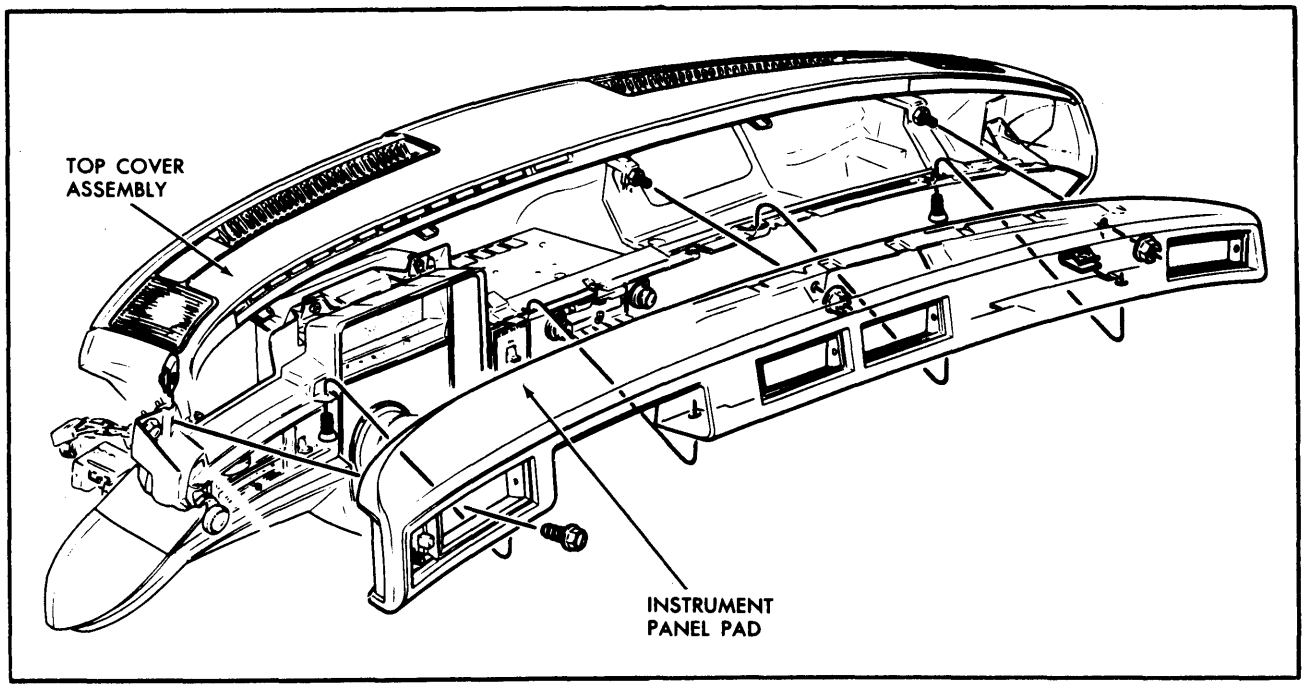


Fig. 12-56 Removing Instrument Panel Pad

BACK TO INDEX

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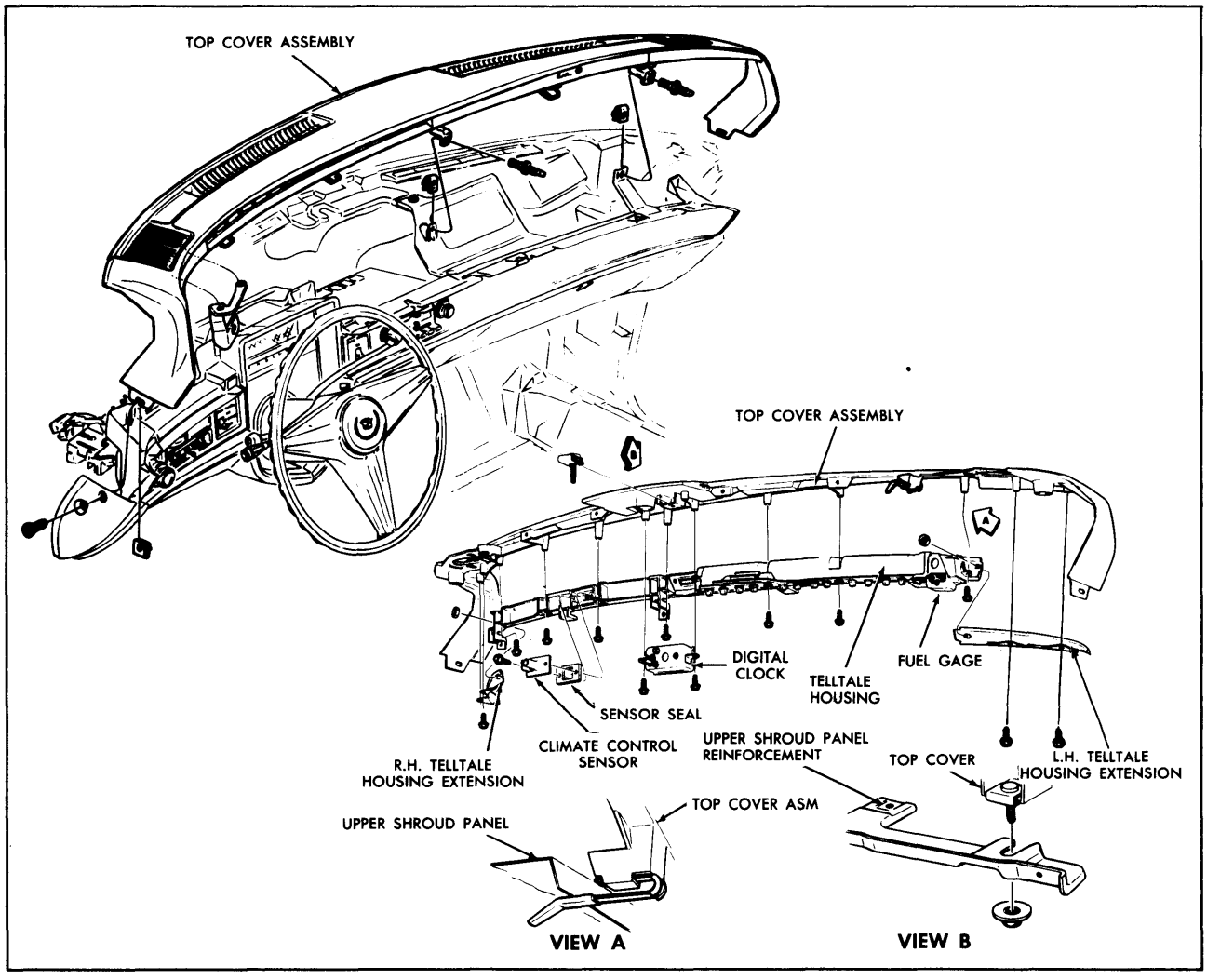


Fig. 12-57 Instrument Panel Top Cover Assembly

b. Installation

1. Position pad to instrument panel and connect electrical connector for wiper switch.
2. Install 4 screws securing pad to instrument panel horizontal support.
3. Working through climate control outlet openings, install 3 fasteners securing pad to instrument panel support.
4. Install air outlet grilles as described in Note 57b.
5. Connect negative battery cable. Tighten to 70 inch pounds.

60. Instrument Panel Top Cover (Fig. 12-57)

a. Removal

1. Remove instrument panel pad as described in Note 59a.
2. Remove screw securing top cover to left and right side of instrument panel.
3. Remove 2 top cover to horizontal support studs.
4. Loosen, but do not remove, nut securing top cover to instrument panel brace on cowl.

(NOTE: Nut is located forward and to the left of the clock.)

5. Working from under panel, disconnect radio front speaker connector at radio.
6. Pull top cover straight out and lift slightly to gain access and disconnect the following connections as required: printed circuit connector, fuel gage connector and bulb, clock connector and bulb, climate control in-car sensor hose and twilight sentinel photocell.
7. Remove top cover.

b. Installation

1. Positon top cover and connect the following connectors as required: printed circuit connector, fuel gage connector and bulb, clock connector and bulb, climate control in-car sensor, and twilight sentinel photocell.
2. Slide top cover into position and tighten nut securing cover to instrument panel brace on cowl.
3. Install screw securing top cover to right side of instrument panel and 2 top cover-to-horizontal support studs.
4. Connect radio front speaker connector at radio.

BACK TO INDEX

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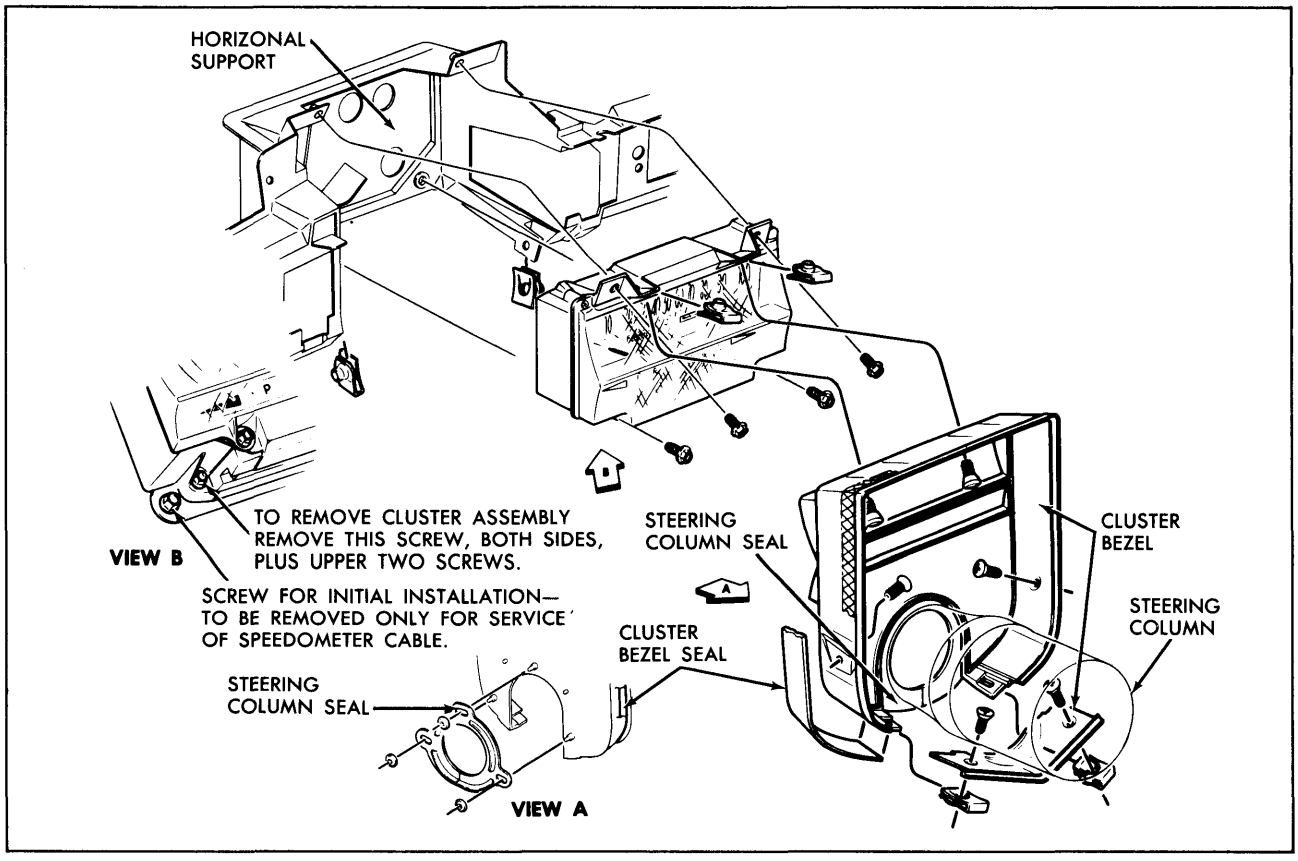


Fig. 12-58 Speedometer Cluster and Bezel

5. Install instrument panel pad as described in Note 59b.

61. Speedometer Cluster Bezel Assembly (Fig. 12-58)

a. Removal

1. Remove 6 screws securing bezel to cluster and remove bezel.

(NOTE: Bezel comes out in two pieces. Steering column seal is attached to bezel and split on lower surface for removal.)

b. Installation

1. Position upper bezel against cluster and secure with 4 screws.
2. Position lower bezel and steering column seal to steering column.
3. Secure with 2 screws.

62. Speedometer Cluster (Fig. 12-58)

a. Removal

1. Disconnect negative battery cable.
2. Remove cluster bezel as described in Note 61a.
3. With shift lever in "P" (Park) remove 1 screw securing shift indicator cable to steering column.
4. Remove 2 upper screws securing cluster assembly to instrument panel horizontal support.
5. Remove 2 lower inboard screws securing cluster to horizontal support.

(NOTE: The 2 outboard screws remain in place for rear speedometer cable mounting.)

6. Pull cluster outward to disengage from speedometer cable, rotate top downward and disconnect printed circuit connector.
7. Remove cluster.

(NOTE: Removal or installation can be facilitated by placing shift lever in low range and on cars equipped with tilt wheel, placing the wheel in lowest position.)

b. Installation

1. Connect printed circuit connector to cluster.
2. Place cluster into position in the instrument panel and engage speedometer cable.
3. Install 4 screws securing cluster to instrument panel.
4. With column in "P" (Park) loosely install screw securing shift indicator cable to steering column and align pointer with column in Neutral. Tighten screw.
5. Install cluster bezel as described in Note 61b.
6. Connect negative battery cable.

63. Cluster Printed Circuit (Fig. 12-25)

a. Removal

1. Remove cluster as described in Note 62a.
2. Remove all sockets and bulbs from cluster case.

BACK TO INDEX

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3. Remove printed circuit.

(NOTE: No attempt should be made to repair this circuit. If inoperative, it should be replaced.)

b. Installation

1. Position printed circuit on back of cluster case.
2. Install all sockets and bulbs into cluster case. See Fig. 12-25.

(NOTE: Black socket should contain a #161 bulb specific to shift indicator illumination. All other sockets are gray with #194 bulbs.)

64. Speedometer Head (Fig. 12-59)

a. Removal

1. Remove speedometer cluster as described in Note 62a.
2. Remove 4 screws securing speedometer cluster lens to cluster housing.
3. Remove trip reset knob by turning counterclockwise. Hold shaft on flats under knob.
4. Remove lens and face plate.
5. Remove selector quadrant assembly from cluster housing by pulling straight out.
6. Remove 2 rubber mounted screws securing speedometer head assembly and remove from cluster housing.
7. Remove 2 screws securing dial to speedometer head and remove dial. Use care not to damage pointer.

b. Installation

1. Install 2 screws securing dial to speedometer head. Use care not to damage pointer.
2. Install 2 screws through rubber bushings in speedometer head assembly and secure to cluster housing.
3. Install selector quadrant assembly to cluster housing.
4. Install face plate and lens. Secure with 4 screws.
5. Install trip reset knob. Turn knob clockwise while holding shaft on flats at outer end.
6. Install speedometer cluster as described in Note 62b and speedometer cluster bezel as described in Note 61b.

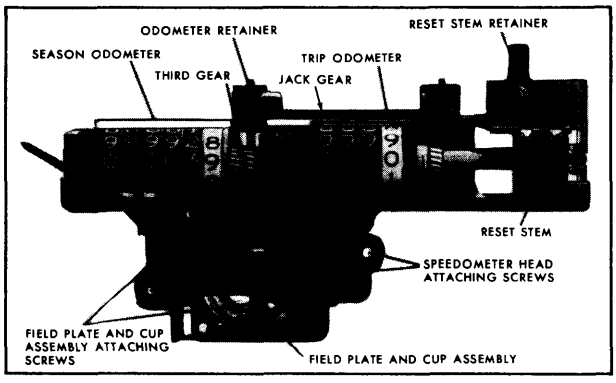


Fig. 12-59 Speedometer Head

SPEEDOMETER HEAD COMPONENT SERVICE

c. Disassembly

1. Remove screw and odometer retainer from plate.
2. Remove trip odometer assembly (trip odometer assembly is serviced only as a complete unit.)
3. Remove season odometer assembly. (Season odometer assembly is serviced only as a complete unit.)
4. Remove jack gear.
5. Remove screw and retainer securing trip reset stem and remove stem.

(NOTE: Further disassembly requires removal of field plate and speed cup assembly and subsequent recalibration of speedometer. If speedometer tester is not available for recalibration, repairs requiring disassembly beyond this point should be referred to your designated speedometer service station.)

6. Carefully remove orange painted pointer assembly (press fit). Turn against zero stop and lightly lift pointer assembly at hub.
7. Remove 2 screws securing field plate to frame and remove field plate and speed cup by lifting out by the speed cup spindle.
8. Remove third gear.
9. Inspect second gear for signs of damage. Do not remove unless necessary. Remove from frame assembly if necessary.

(NOTE: Further disassembly, such as removal of the magnet shaft from frame and speed cup assembly is not recommended.)

d. Assembly

1. If removed, position second gear in frame assembly with gear end contacting worm gear magnet shaft.
2. Position third gear with bevel gear end engaging worm gear end on second gear.
3. If removed, install speed cup (with notched side up) and field plate by holding speed cup spindle and guiding assembly onto dowels. Retain with 2 screws and tighten uniformly.

(NOTE: Make sure speed cup stop tab is on correct side of field plate so as to permit needle rotation. Hairspring coil on speed cup must be evenly spaced when in wound position. It may be necessary to use tweezers to adjust coils. Move regulator arm to horizontal position, if necessary, so that maximum adjustment may be made in either direction during calibration.)

4. Install trip odometer reset shaft, retainer plate and screw, being sure retainer plate engages groove in reset stem.
5. Install jack gear.
6. Rotate all odometer wheels to the top of their travel.
7. Wipe odometers clean of fingerprints with a lint free cloth or soft chamois.
8. Install odometers, making sure slotted ears of pinion carriers fit in locating slots.

BACK TO INDEX

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9. Install retainer plate and secure with screw.
10. Mount pointer on tapered spindle so that it points at approximately 30 mph. Twist pointer back to, and in line with, "O" graduation while pressing down lightly.
11. Check for secure pointer to spindle contact by inserting a short piece of speedometer cable with proper tip in drive end of speedometer. An initial fast spin of test cable should swing pointer to approximately 30 mph and then briskly return to "O". Perform this test several times. If pointer becomes loose on spindle, repeat Step 10.
12. If during the performance of Step 11, pointer returns to "O" intermittently or not at all, this indicates a speed cup and magnet assembly malfunction.
13. If field plate and speed cup assembly were removed, calibrate speedometer assembly, following the instructions furnished by the manufacturer for the speedometer tester being used.
14. Install speedometer head assembly as described in Note 64b.

65. Twilight Sentinel Photocell (Fig. 12-65)

(NOTE: Should it be necessary to replace the photocell, both photocell and amplifier must be replaced as a matched set.)

a. Removal

1. Disconnect negative battery cable.
2. Remove three climate control air outlet grilles–right, left, and right center–as described in Note 59a.
3. Working through outlet openings, remove 3 fasteners securing pad to instrument panel support.
4. Remove screws securing pad to horizontal support and move pad rearward to gain access to photocell.
5. Rotate plastic photocell holder counterclockwise to remove from underside of top cover.
6. Remove photocell from plastic holder.

b. Installation

1. Insert photocell into plastic holder.
2. Insert plastic holder into underside of top cover and rotate clockwise.
3. Position pad and secure with screws to horizontal support.
4. Working through climate control outlet openings, install 3 fasteners securing pad to instrument panel support.
5. Install air outlet grilles as described in Note 59b.
6. Connect negative battery cable. Tighten to 70 inch pounds.

66. Twilight Sentinel Amplifier (Fig. 12-55)

(NOTE: Should it be necessary to replace an amplifier, both amplifier and photocell must be replaced as a matched set.)

a. Removal

1. Remove 2 screws and washers securing amplifier to lower steering column cover reinforcement.
2. Disconnect electrical connector at amplifier and remove amplifier.

b. Installation

1. Connect electrical connector at amplifier.
2. Position amplifier on lower steering column cover reinforcement and secure with 2 screws and washers.

67. Tell-Tale Printed Circuit

a. Removal

1. Remove instrument panel top cover as described in Note 60a.
2. With cover lying top down on bench, remove all tell tale bulbs and sockets.

(NOTE: Bulbs must be reinstalled in correct locations for proper functioning of tell tale circuits.)

3. Remove screws securing printed circuit to tell tale housing and remove printed circuit.

b. Installation

1. Position printed circuit on tell tale housing and secure with one screw.

(NOTE: Circuit is positioned to connector opening with double sided tape. Printed circuit tabs must be centrally positioned to insure proper connections.)

2. Install all tell tale bulbs and sockets.
3. Install top cover as described in Note 60b.
4. Install instrument panel pad as described in Note 59b.

68. Tell-Tale Housing (Components and Lenses) (Fig. 12-57)

a. Removal

1. Remove tell-tale printed circuit as described in Note 67a.
2. Remove 2 screws securing fuel gage and remove gage.
3. Remove remaining tell tale housing and extensions to top cover screws and remove housing assembly.
4. Remove tell tale housing cover screws, cover and tell tale lenses.

b. Installation

1. Position tell tale lenses into housing install cover and secure with screws.
2. Position tell tale housing onto top cover and install attaching screws.
3. Install fuel gage to tell tale housing with 2 screws.
4. Attach printed circuit board to tell tale housing cover.
5. Install printed circuit connector and bulbs.

BACK TO INDEX

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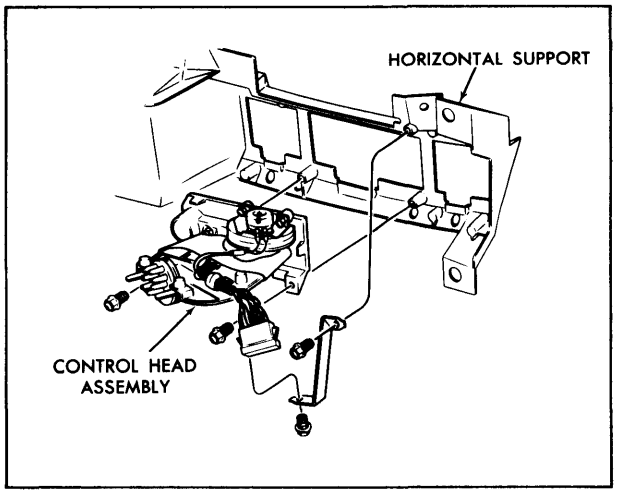


Fig. 12-60 Air Conditioner Control Head

6. Install instrument panel top cover as described in Note 60b and instrument panel pad as described in Note 59b.

69. Air Conditioning Control Head (Fig. 12-60)

a. Removal

1. Disconnect negative battery cable.
2. Remove lower steering column cover as described in Note 58a.
3. Remove 2 control to support mounting screws.
4. Remove control to bracket mounting screw from left rear corner of control.
5. Remove control from support and disconnect vacuum connector, electrical connector and bulb.

b. Installation

1. Connect vacuum connector, electrical connector and bulb to control.
2. Install control to support and bracket and attach with 3 mounting screws.
3. Install lower steering column cover as described in Note 58b.
4. Connect negative battery cable. Tighten to 70 inch pounds.

70. Climate Control In-Car Sensor (Fig. 12-57)

a. Removal

1. Remove instrument panel top cover as described in Note 60a.
2. Disconnect aspirator hose from sensor. Remove 2 screws securing sensor to tell tale assembly and remove sensor.

b. Installation

1. Position sensor on tell tale assembly and secure with 2 screws. Connect aspirator hose to sensor.
2. Install instrument panel top cover as described in Note 60b. and instrument panel pad as described in Note 59b.

71. Climate Control Outlet Doors and Bezels (Fig. 12-61)

a. Removal

1. Remove instrument panel pad as described in Note 59a.
2. With pad lying face down on bench, remove 2 screws and plastic guides securing door to pad and remove door.

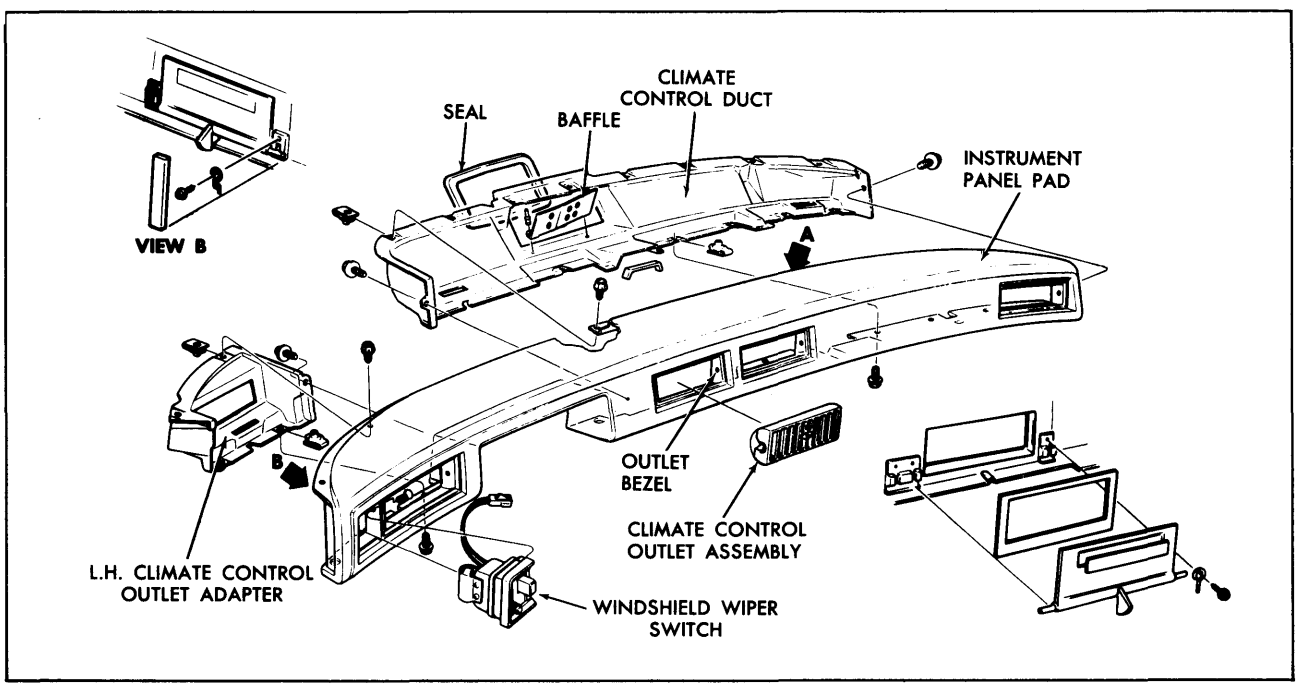


Fig. 12-61 Instrument Panel Pad—Disassembled

BACK TO INDEX

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3. Push bezel out of pad from the rear side of the pad.

b. Installation

1. Push bezel into instrument panel pad from the front side of the pad.
2. Position door on pad and secure with 2 plastic guides and screws.
3. Install instrument panel pad as described in Note 59b.

72. Climate Control Duct—Left Side (Fig. 12-61)

a. Removal

1. Remove instrument panel pad as described in Note 59a.
2. Remove 4 screws securing duct to cover and remove duct.

b. Installation

1. Positon duct on cover and secure with 4 screws.
2. Install instrument panel pad as described in Note 59b.

73. Climate Control Duct—Right Side (Fig. 12-61)

a. Removal

1. Remove instrument panel pad as described in Note 59a.
2. With panel lying face down on bench, remove 15 screws securing right hand duct to panel and remove duct.

b. Installation

1. Position duct onto panel and secure with 15 screws.
2. Install instrument panel pad as described in Note 59b.

74. Windshield Wiper Switch (Fig. 12-61)

a. Removal

1. Disconnect negative battery cable.
2. Remove left hand climate control outlet grille as described in Note 57a.
3. Working through outlet opening, remove screw securing switch to instrument panel.
4. Pull wiper switch and electrical connector out of panel and disconnect from harness.

b. Installation

1. Install electrical connector to harness and position switch into instrument panel pad opening.
2. Working through air outlet grille, install screw securing switch to instrument panel.
3. Install left hand climate control outlet grille as described in Note 57b.
4. Connect negative battery cable. Tighten to 70 inch pounds.

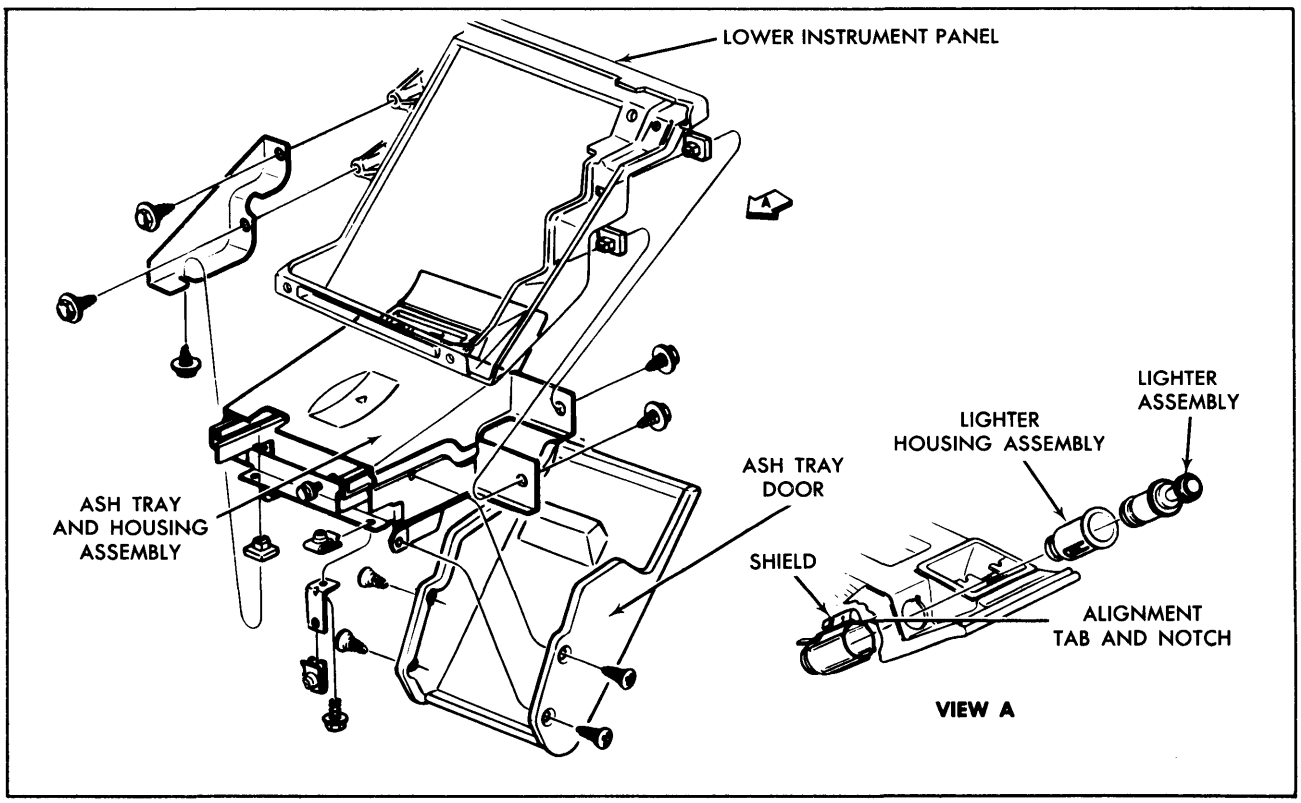


Fig. 12-62 Ash Tray—Disassembled

BACK TO INDEX

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75. Ash Tray (Fig. 12-62)

a. Removal

1. Remove lower steering column cover as described in Note 58a.
2. Remove ash tray lower bracket to reinforcement screw.
3. Remove 2 attaching screws on left ash tray mounting bracket.
4. Remove right hand ash tray attaching screw (use 5/16 nutrunner or socket with 3" extension and work from lower edge of instrument panel.)
5. Remove ash tray from instrument panel and disconnect electrical connector and bulb.

b. Installation

1. Install electrical connector and bulb.
2. Position ash tray and loosely install screws.
3. Align right side with instrument panel lower cover and tighten screws.
4. Install lower steering column cover as described in Note 58b.

76. Ash Tray Door and Cigar Lighter Base Assembly (Fig. 12-62)

a. Removal

1. Open ash tray and depress flat stop spring.
2. Pull ash tray out just enough to gain access to 4 screws.
3. Remove 4 screws securing ash tray door to ash tray housing.
4. Disconnect cigar lighter electrical connector.
5. Disconnect ash tray housing bulb and shield.
6. Remove lighter base from sleeve by holding sleeve and rotating lighter base.
7. Remove lighter base from ash tray housing.

b. Installation

1. Position lighter base in ash tray housing.
2. Hold lighter sleeve in position and screw base into sleeve. Bulb shield must face up when tight to allow light to enter ash tray receptacle.
3. Connect ash tray housing bulb shield and feed wires to cigar lighter base.
4. Secure ash tray door to ash tray housing with 4 screws.
5. Depress flat stop spring and push ash tray assembly forward.

77. Left Hand Instrument Panel Insert (Fig. 12-63)

a. Removal

1. Remove lower steering column cover as described in Note 58a.
2. Remove 4 screws securing insert to horizontal support.

b. Installation

1. Positon insert on instrument panel and secure with 4 screws.
2. Install lower steering column cover as described in Note 58b.

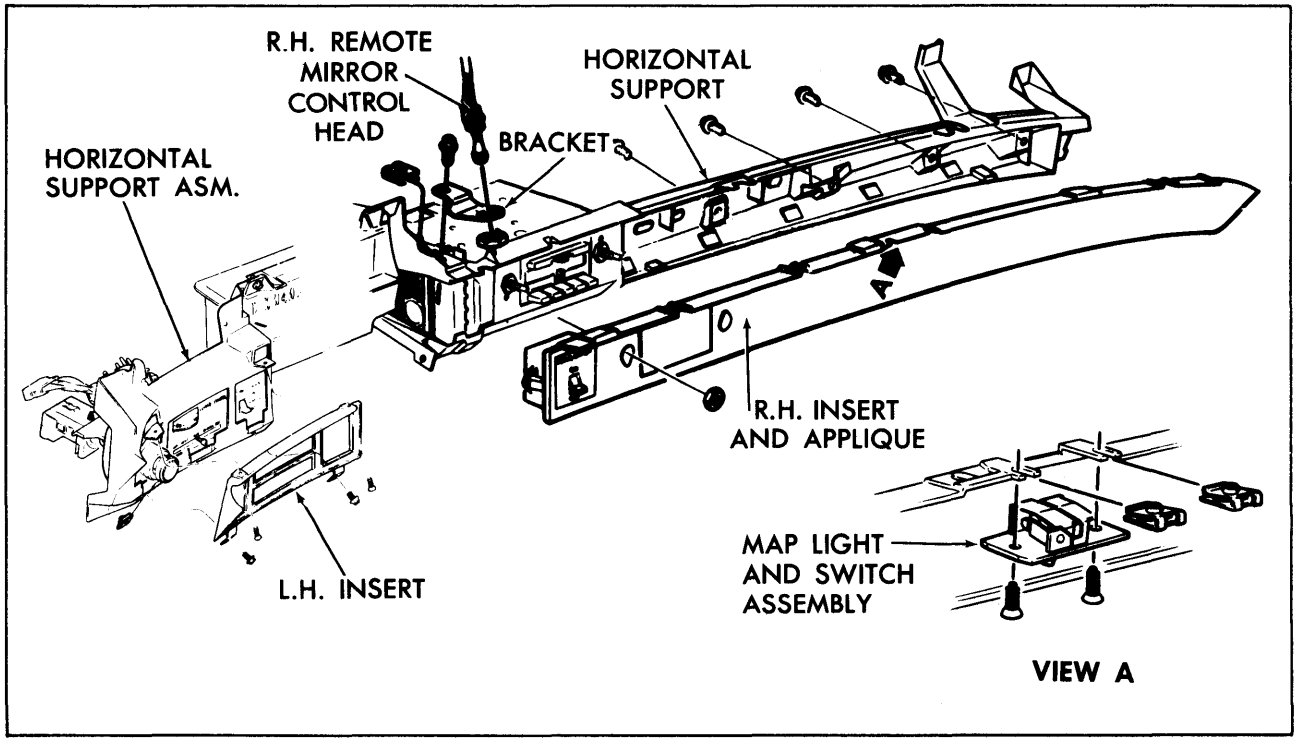


Fig. 12-63 Inserts, Map Light and R.H. Mirror Control

BACK TO INDEX

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78. Right Hand Instrument Panel Insert and Applique (Fig. 12-63)

a. Removal

1. Remove radio knobs, anti rattle springs, control rings and left hex nut.
2. Remove attaching screws from rear of insert through opening in top of glove box.
3. Push accessory switch(es) until it "snaps" out of insert and applique and disconnect bulbs carefully noting which lamps go to each switch.

(NOTE: Incorrect installation will affect accessory switch lighting. See Fig. 12-66.)

4. Disconnect map light connector.

b. Installation

1. Connect map light connector.
2. Connect accessory switch(es) and bulbs to insert and applique in the exact position from which they were removed. See Fig. 12-66.
3. Position insert and applique onto support and install screws.
4. Install left hex nut, control rings, anti rattle springs and radio knobs.

79. Headlamp Switch (Guide Matic or Twilight Sentinel Switch) (Fig. 12-64)

a. Removal

1. Disconnect negative battery cable.
2. Remove lower steering column cover as described in Note 58a.
3. Disconnect headlamp electrical connector and lower bulb.
4. Pull knob to "headlamps on" position, depress spring loaded button on top side of switch and while holding the button remove the knob, escutcheon and washer.
5. Remove 3 headlamp switch case to instrument panel support screws.
6. Lower switch assembly, disconnect upper bulb and remove switch.

b. Installation

1. Position switch assembly (connector down), install upper bulb and position into instrument panel horizontal support.
2. Secure with 3 attaching screws.
3. Install knob, escutcheon and washer by depressing spring loaded button on top side of switch and while holding the button insert the knob, escutcheon and washer into the switch.
4. Connect headlamp electrical connector and lower bulb.
5. Install lower steering column cover as described in Note 58b.
6. Connect negative battery cable. Tighten to 70 inch pounds.

80. Cruise Control Switch

a. Removal

1. Disconnect negative battery cable.

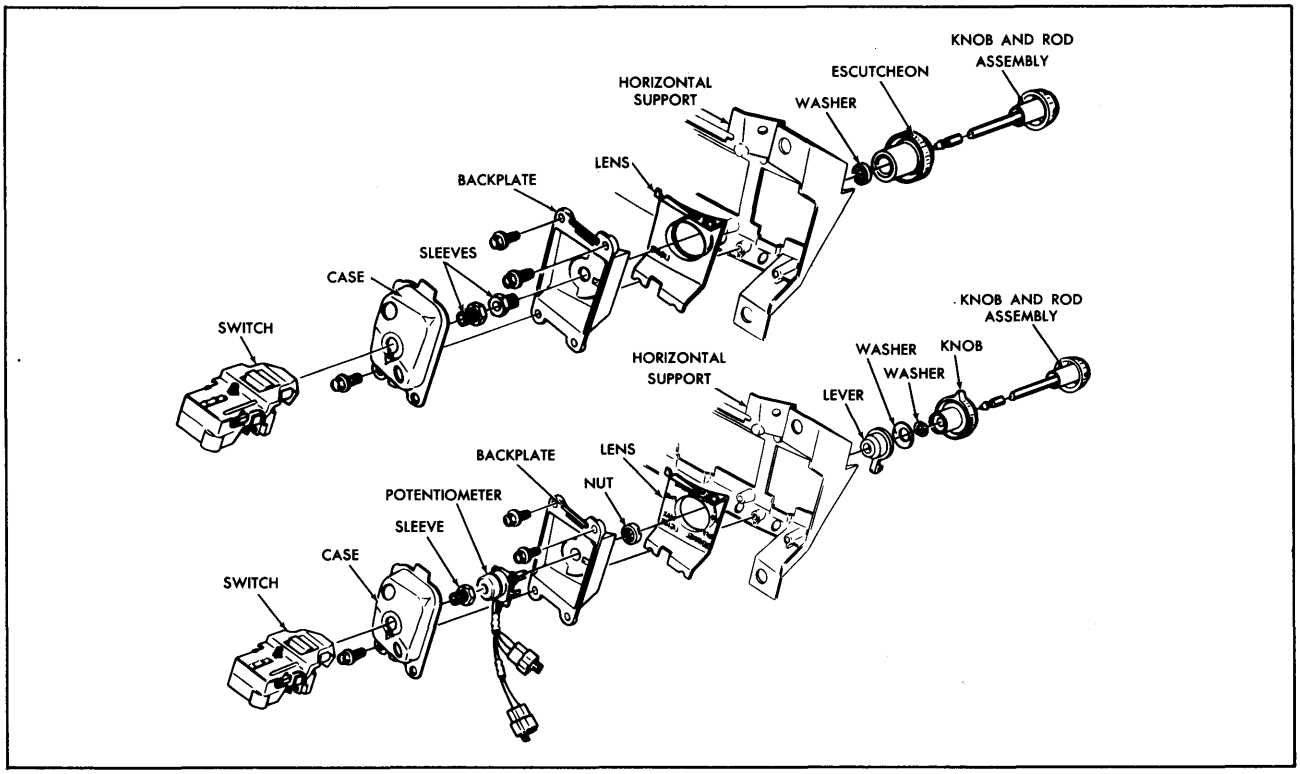


Fig. 12-64 Headlamp Switches—Disassembled

BACK TO INDEX

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2. Remove lower steering column cover as described in Note 58a.
3. Disconnect cruise control electrical connectors and bulbs.
4. Remove 2 switch to instrument panel horizontal support screws.

(NOTE: Use of a three inch extension will aid in the removal of upper screw.)

5. Remove switch assembly.

b. Installation

1. Position switch assembly into instrument panel and install 2 attaching screws.
2. Connect cruise control electrical connectors and bulbs.
3. Install lower steering column cover as described in Note 58b.
4. Connect negative battery cable. Tighten to 70 inch pounds.

81. Radio Receiver Unit

(NOTE: See Note 51 for power antenna.)

a. Removal

1. Remove ash tray as described in Note 75a.
2. Remove radio knobs, anti-rattle springs, control rings and hex nuts.
3. Remove radio to lower instrument panel support brace nut at rear of radio.
4. Loosen brace to support screw and rotate brace to the right.
5. Slide radio from instrument panel and disconnect antenna cable, speaker connector and power connector.
6. Rotate dial side downward and lower the left hand side of the radio. Remove through ash tray opening.

b. Installation

1. Position radio into instrument panel, connect antenna cable, speaker connector and power connector.
2. Install brace onto radio and tighten support screws.
3. Install radio to brace nut.
4. Install hex nuts, anti-rattle springs, and radio knobs.
5. Install ash tray as described in Note 75b.
6. Install lower steering column cover as described in Note 58b.

82. Radio Front Speakers (Fig. 12-65)

a. Removal

1. Left Speaker–Remove instrument panel pad as described in Note 59a. Remove screw, disconnect air duct and push forward. Right speaker may be removed by working through access area in top of glove box.
2. Depress spring retainer, and remove speaker.
3. If speaker is malfunctioning cut wires and remove.

b. Installation

1. Position speaker in top cover and secure with retaining spring.
2. Cut wires to proper length and splice into new speaker leads. Solder or crimp with solderless connector.
3. Left Speaker–Install air duct and secure with screw. Install instrument panel pad as described in Note 59b.

83. Radio Front Speaker Grilles (Fig. 12-65)

a. Removal

1. Remove instrument panel top cover as described in Note 60a.
2. Remove speaker by releasing spring retainer.
3. Remove 2 screws securing speaker mounting brackets to top cover and remove brackets.

(NOTE: Left grille:
a. Remove 2 screws securing tell tale extension to top cover.
b. Remove 8 screws securing tell tale base top cover. Remove tell tale side clock mounting screw only.
c. Carefully pivot tell tale assembly to gain access to speaker mounting screw.)

4. Remove 2 screws securing speaker grille to top cover and remove grille.

b. Installation

1. Position speaker grille on top cover and secure with two screws.

(NOTE: Left grille–install tell tale base and extension to top cover.)

2. Install speaker mounting brackets and secure each with 2 screws.
3. Install speaker with retaining spring.
4. Install instrument panel top cover as described in Note 60b.
5. Install instrument panel pad as described in Note 59b.

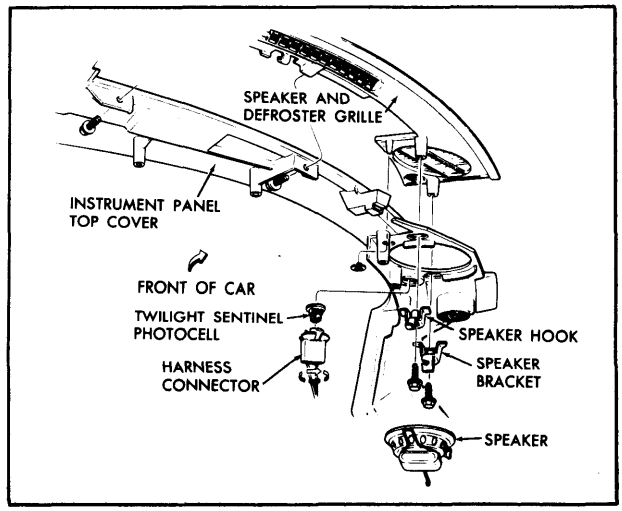


Fig. 12-65 Radio Speaker and Speaker/Defroster Grille

BACK TO INDEX
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84. Power Antenna Relay

a. Removal

1. Pull carpet away from front passenger side toe pan.
2. Disconnect 2 electrical connectors.
3. Remove 2 screws and washers securing relay and bracket to toe pan.

b. Installation

1. Position relay and bracket on toe pan and secure with 2 screws.
2. Connect electrical connectors.
3. Reposition carpet.

85. Trunk Release Switch

a. Removal

1. Open glove box door.
2. Reaching through glove box liner access hole, disconnect electrical connector from trunk release switch.
3. Depress tabs on trunk release switch and remove from passenger side of panel.

b. Installation

1. Depress tabs on trunk release switch and carefully insert switch into mounting cutout.
2. Reach through top of glove box liner to make certain tabs are fully extended.
3. Connect electrical connector to switch.
4. Depress switch button to check trunk release for proper operation.

86. Theft Deterrent Controller

See Section 15 for removal and installation of theft deterrent controller.

87. Track Master Controller

(NOTE: Controller is mounted to top of glove box liner.)

a. Removal

1. Reaching through the top of glove box, disconnect the electrical connectors from the upper right hand side of the controller.
2. Loosen 2 attaching nuts.
3. Remove controller through glove box liner opening.

b. Installation

1. Working through the opening in the top of glove box position controller onto glove box liner.
2. Tighten 2 attaching nuts.
3. Connect the electrical connectors to the upper right hand side of the controller.

(NOTE: The connectors are not interchangeable. The connector toward the front of the car is notched.)

88. Accessory Switches and Housing (Power Antenna, Defogger, Sun Roof, Convertible Top) (Fig. 12-63)

a. Removal

1. Remove instrument panel pad as described in Note 59a.
2. Remove right hand insert and applique as described in Note 78a.
3. Push switch from insert and applique side of instrument panel until it "snaps" out of the accessory switch housing.

(NOTE: Accessory switch housing need not be removed in accessory switch replacement.)

4. Remove accessory switch wiring terminals from accessory switch electrical connector.
5. Remove 2 screws and accessory switch housing.

b. Installation

1. Position accessory switch housing and install 2 housing to instrument panel support screws.
2. Install accessory switch wiring terminals into accessory switch electrical connector.

(NOTE: See chassis wiring circuit diagram on rear cover gatefold for wiring color codes.)

3. Push accessory switch into the switch housing until it "snaps" into position.
4. Install right hand insert and applique as described in Note 78b.
5. Install instrument panel pad as described in Note 59b.

89. Accessory Switch Bulb Replacement (Power Antenna, Defogger, Sun Roof, Convertible Top) (Fig. 12-66)

a. Removal

1. Remove radio knobs, anti rattle springs, control rings and left hand hex nut.
2. Remove left hand insert and applique to horizontal support screw.
3. Gently pull left edge of applique until bulb sockets are exposed.
4. Remove bulb.

(NOTE: Proper bulb location and type are important to ensure correct accessory switch lighting.)

b. Installation

1. Install new bulb.
2. Position insert and applique against horizontal support.
3. Install left hand retaining screw.
4. Install left hand radio hex nut, control rings, anti rattle springs and knobs.

90. Fuel Gage (Fig. 12-57)

a. Removal

1. Remove instrument panel top cover as described in Note 60a.

BACK TO INDEX

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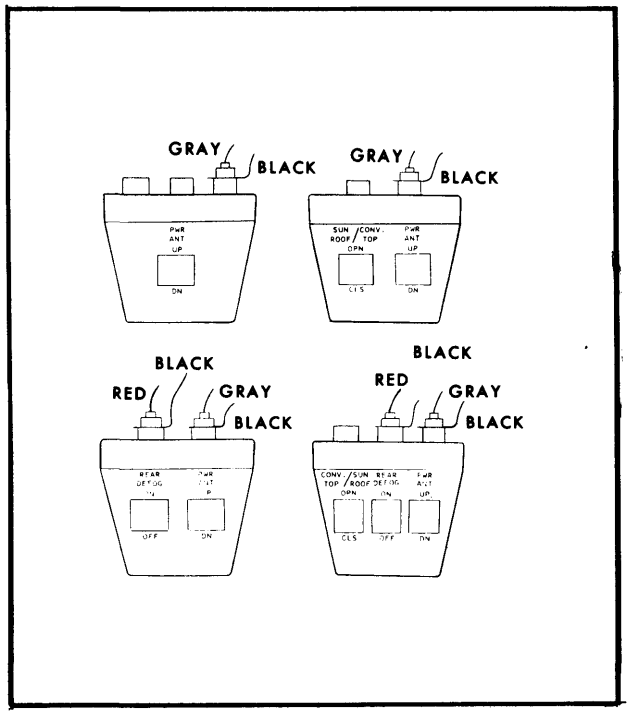


Fig. 12-66 Accessory Switch Wiring

2. Remove 3 nuts securing wiring to fuel gage, Fig. 12-26.
3. Remove 2 screws securing fuel gage to telltale housing.

b. Installation

1. Position fuel gage on telltale housing and secure with 2 screws.
2. Install electrical connectors.
3. Install instrument panel top cover as described in Note 60b and instrument panel pad as described in Note 59b.

91. Digital Clock (Fig. 12-57)

a. Removal

1. Remove instrument panel top cover as described in Note 60a.
2. Disconnect electrical connector and bulbs.
3. Remove 2 screws securing clock to top cover.

CAUTION: Pull clock straight back to avoid damaging the reset stem.

4. Remove clock.

b. Installation

1. Install bulb and electrical connector.
2. Position clock on top cover using care to align reset stem with hole in lens and secure with 2 screws.
3. Install instrument panel top cover as described in Note 60b and instrument panel pad as described in Note 59b.

92. Rear Window Defogger Timer Relay and Circuit Breaker

a. Removal

1. Disconnect negative battery cable.
2. Remove lower steering column cover as described in Note 58a.
3. Remove 2 screws which attach relay to lower steering column cover reinforcement.
4. Disconnect electrical connectors and remove relay.

b. Installation

1. Connect electrical connectors.
2. Secure relay to lower steering column cover reinforcement with 2 screws.
3. Install lower steering column cover as described in Note 58b.
4. Connect negative battery cable.

93. Hood Lock Primary Release

a. Removal

1. Remove clip from cable at hood lock.
2. Thread cable from radiator cradle.
3. Remove screws securing left side sill plate and remove sill plate.
4. Remove screw securing left side kick panel.
5. Partially remove kick panel to gain access to lock handle.
6. Pull handle bracket from behind tab on kick panel and remove cable assembly.

b. Installation

1. Thread cable through kick panel and fire wall.
2. Install handle assembly in kick panel so that handle is vertical and away from panel as far as possible.
3. Install handle assembly by securing under tab on kick panel.
4. Position kick panel and secure with screw.
5. Install sill plate and secure with screws.
6. Thread cable through inside of fender well and secure to hood lock latch with clip.

94. Glove Box Liner

a. Removal

1. Remove Track Master Controller from top of glove box liner as described in Note 87a if car is so equipped.
2. Remove 5 screws that secure glove box liner to glove box housing.

CAUTION: Do not apply excessive downward pressure to the door at this point, as it may break the glove box door hinge.

3. Carefully remove glove box liner through door opening.

b. Installation

1. Position glove box liner into housing through door opening.
2. Align glove box liner to housing and secure with 4 attaching screws, leaving the upper right screw out.
3. Position right hand door stop cable to liner at upper right hand position and secure with remaining screw.

BACK TO INDEX

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4. Install Track Master Controller on top of liner as described in Note 87b, if so equipped.

95. Glove Box Door

a. Removal

1. From underside of instrument panel, remove three hinge to support screws.
2. Open glove box door and remove door stop cable screw.
3. Remove door.

b. Installation

1. Position glove box door and attach door stop cable screw.
2. Loosely install three hinge to support screws.
3. Close glove box door, align with lower instrument panel and tighten screws.

96. Glove Box Lock Cylinder

a. Removal

1. Open glove box door.
2. Insert key and pull latch mechanism arm to latch position. Turn key to lock position and remove key.
3. Through slot in top of lock case, depress cylinder retainer and insert key into lock cylinder.
4. Release retainer and remove lock cylinder assembly.

(NOTE: Lock cylinder knob is not serviced separately from cylinder.)

b. Installation

1. While holding lock cylinder assembly in hand depress retainer (tumbler closest to knob) insert key and release retainer. All tumblers and retainer should be flush with lock cylinder housing.
2. Install cylinder into case with retainer at top and rotate key and lock cylinder clockwise until a "click" is heard.
3. Close glove box door, remove key and check for proper operation.

97. Glove Box Lock Case

a. Removal

1. Remove lock cylinder as described in Note 96a.
2. Remove escutcheon.
3. Remove washer, filler and lock cylinder case.

b. Installation

1. Position lock cylinder, filler and washer onto glove box door.
2. Install escutcheon.
3. Install lock cylinder as described in Note 96b.

98. Right Hand Rear View Mirror

a. Removal

1. Remove right hand door upper and lower trim panels as described in the body service manual.
2. Remove instrument panel pad as described in Note 59a.
3. Remove control head by loosening nut on support bracket.
4. Remove remote control cable from clips at glove box and front door outer panel reinforcement.
5. Remove cable from front door conduit.
6. Remove 2 nuts securing mirror to door and pull mirror and cable out of door outer panel.

b. Installation

1. Insert mirror in door outer panel, feeding remote control cable through large center hole.
2. Secure mirror to door outer panel with two nuts.
3. Feed cable through front door conduit and over glove box to support bracket.
4. Secure cable to glove box and front door inner panel reinforcement clips.
5. Install control head in support bracket and install nut.
6. Install instrument panel pad as described in Note 59b.
7. Install upper and lower front door trim panels as described in the body service manual.

99. Electronic Control Unit (ECU) (Fig. 12-67)

a. Removal

1. Disconnect negative battery cable.
2. Remove three climate control outlet grilles – right, left and right center, Fig. 12-54.
3. Working through outlet openings, remove 3 fasteners securing pad to instrument panel support, Fig. 12-56.
4. Remove screws securing pad to instrument panel horizontal support, Fig. 12-56.
5. Pull pad outward and disconnect electrical connector from windshield wiper switch.
6. Remove pad.

(NOTE: To facilitate removal or installation, place shift lever in lo range and on cars equipped with tilt wheel, place wheel in lowest position.)

7. Remove MAP sensor hose, Fig. 12-67.
8. Remove three mounting screws holding ECU in position (one in front, two at side bracket, Fig. 12-67) and remove ECU.
9. Disconnect electrical connectors (3) from side of ECU.

b. Installation

1. Connect electrical harness to ECU – 3 connectors. Connectors will only fit one way, black towards front of car, blue in center and red towards rear.
2. Position ECU with electrical connectors on right side of car and install three mounting screws, Fig. 12-67.
3. Install MAP sensor hose, Fig. 12-67.
4. Position pad to instrument panel and connect electrical connector for wiper switch.
5. Install screws securing pad to instrument panel horizontal support.
6. Working through climate control outlet openings, install 3 fasteners securing pad to instrument panel support.

BACK TO INDEX

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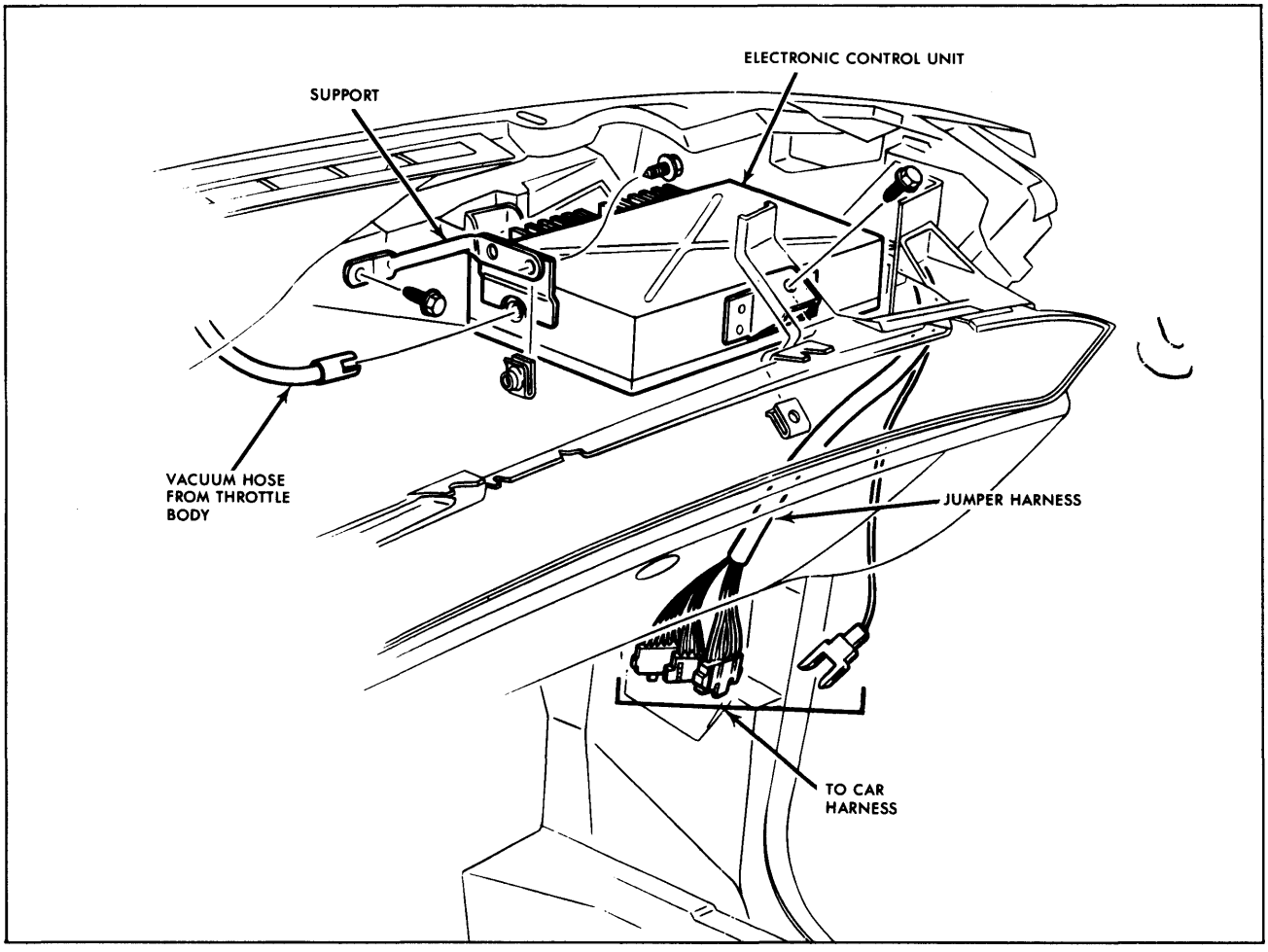


Fig. 12-67 Fuel Injection ECU Mounting

7. Install air outlet grilles as described in Note 57.
8. Connect negative battery cable.

100. Seat Belt Timer and Buzzer Assembly

a. Removal

1. Remove lower steering column cover as described in Note 58a.
2. Remove timer and buzzer assembly from L.H. body bracket.
3. Disconnect electrical connector.

b. Installation

1. Connect electrical connector to timer and buzzer assembly.
2. Install timer and buzzer assembly to L.H. body bracket.
3. Install lower steering column cover as described in Note 58b.

SERVICE INFORMATION INSTRUMENT PANEL COMPONENTS ON AIR CUSHION RESTRAINT SYSTEM EQUIPPED CARS

CAUTION: Before servicing any instrument panel component turn ignition switch to "lock," disconnect negative battery cable and tape terminal end to avoid accidental deployment.

On the items listed below remove the Driver Knee Restraint (as described in Note 103a) instead of the lower steering column cover. Then proceed as described in corresponding notes for non Air Cushion Restraint System Equipped Cars.

L.H. Instrument Panel Insert
Headlamp Switch
Guide Matic or Twilight Sentinel Switch
Cruise Control Switch.
Air Conditioner Control
Rear Window Defogger Relay

101. Glove Box (Fig. 12-69)

a. Removal

1. Turn ignition switch to "lock" position. Disconnect negative battery cable and tape terminal end.
2. Remove three screws securing glove box to

BACK TO INDEX

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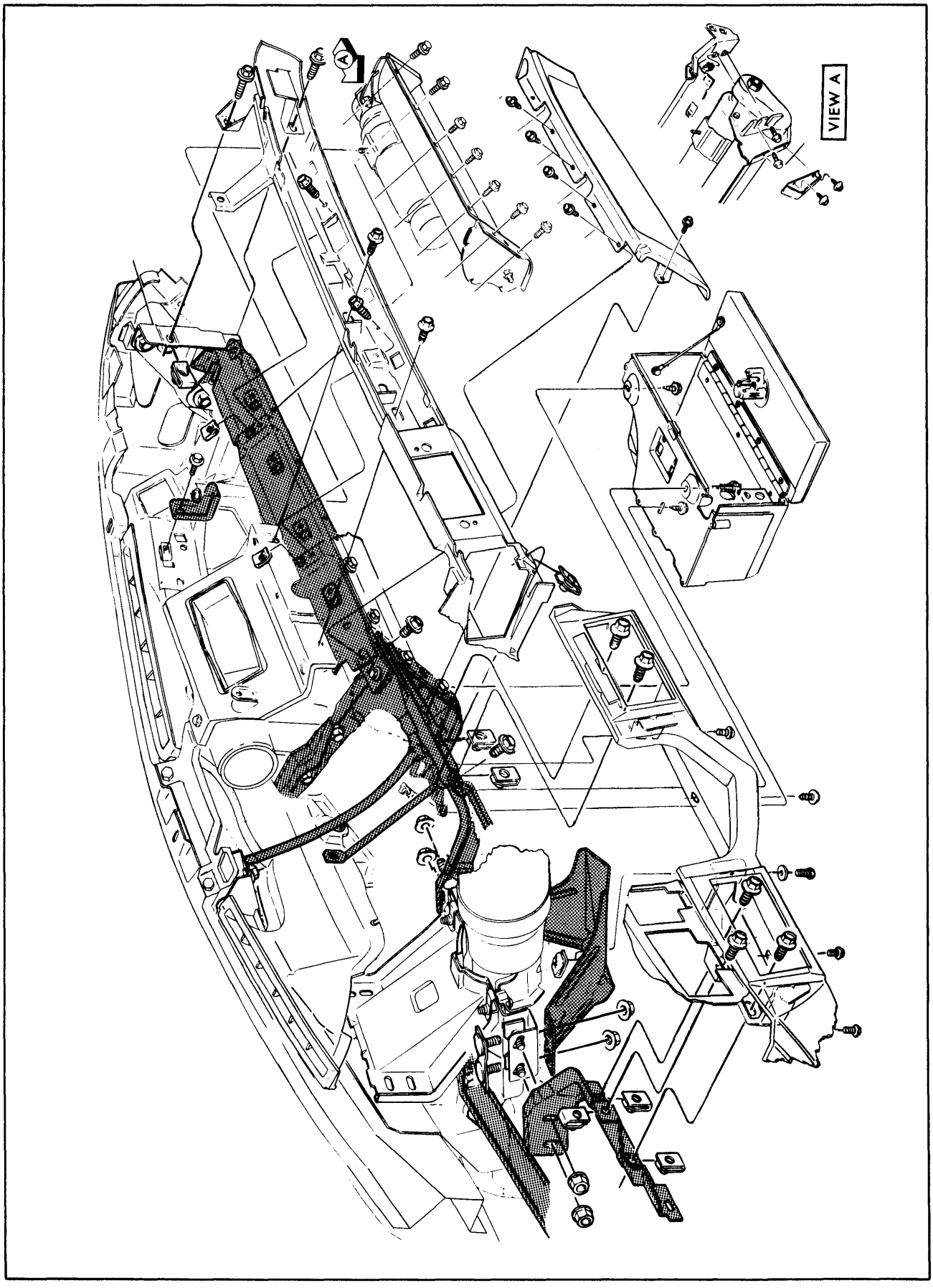


Fig. 12-68 A.C.R.S. Instrument Panel Components

BACK TO INDEX

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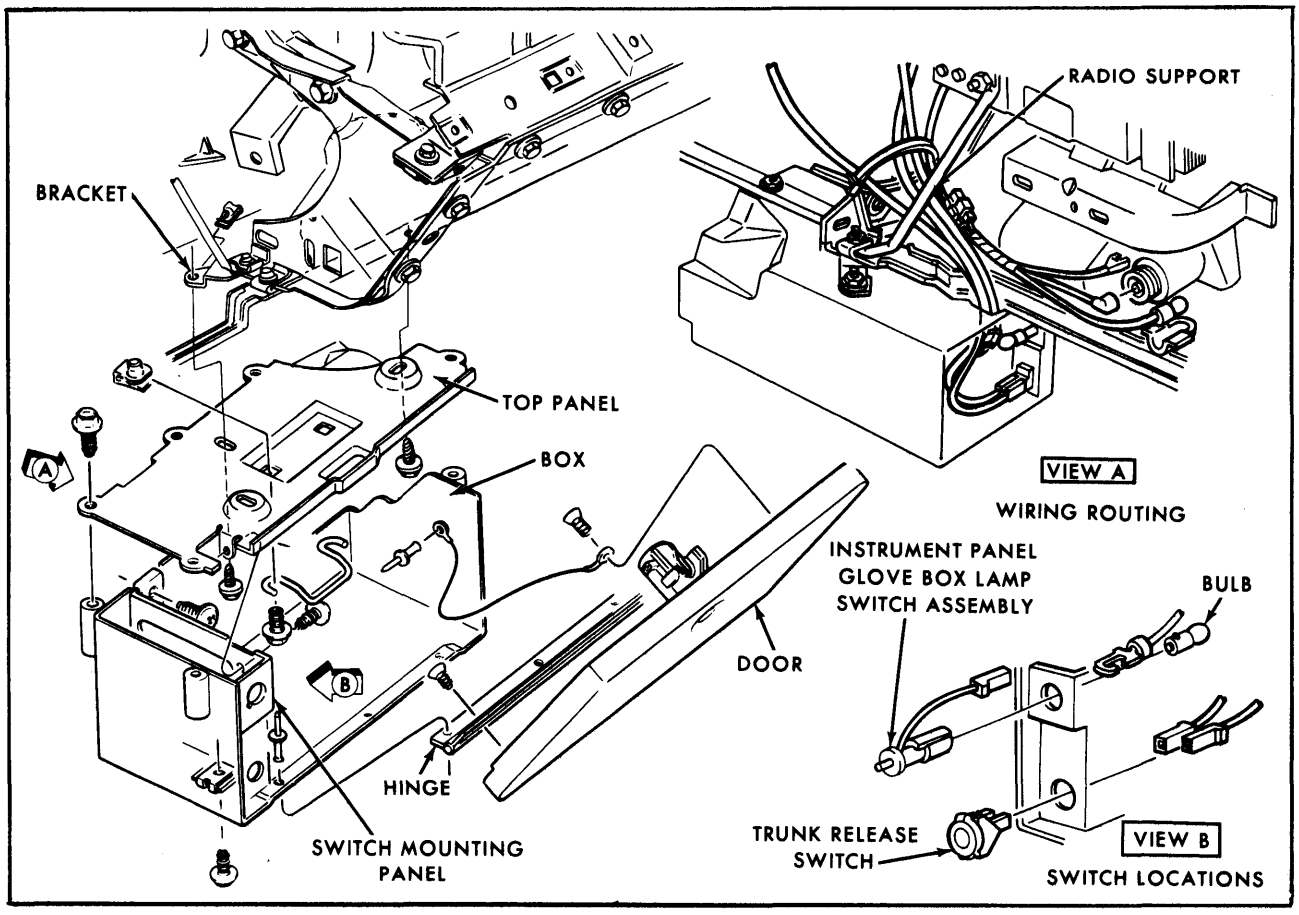


Fig. 12-69 A.C.R.S. Glove Box Assembly

instrument panel. Do not remove two striker screws.

(NOTE: Electrical lead wire length is sufficient to permit glove box to be placed aside while removing additional instrument panel component parts. Continue with the following steps only if glove box is to be removed from car.)

3. Remove 3 screws securing glove box partition.
4. Disconnect electrical connectors. Feed wires through top of glove box and remove glove box.

b. Installation

1. Feed electrical connectors through top of glove box and connect to connectors mounted to partition.
2. Position partition and secure with 3 screws.
3. Position glove box under instrument panel and secure with three screws.
4. Connect negative battery cable. Tighten to 70 inch pounds.

102. Trunk Release Switch

a. Removal

1. Disconnect negative battery cable and tape terminal end.
2. Remove 3 screws attaching glove box to instrument panel.
3. Remove 3 screws securing glove box partition.
4. Disconnect electrical connector and remove switch.

b. Installation

1. Install switch in glove box partition.
2. Install partition and secure with 3 screws.
3. Position glove box under instrument panel and secure with 3 screws.
4. Connect negative battery cable. Tighten to 70 inch pounds.

103. Driver Knee Restraint (Fig. 12-70)

a. Removal

1. Turn ignition switch to "lock" position. Disconnect negative battery cable and tape terminal end.
2. Remove glove box as described in Note 101a.
3. Remove 2 screws securing tape storage compartment.
4. Remove 2 screws securing ash tray assembly. Pull out part way, disconnect electrical connectors and remove ash tray assembly.
5. Remove left trim screw from knee restraint.
6. Remove four screws from lower edge of knee restraint and loosen (but do not remove) fifth screw directly below steering column.
7. Working through tape storage compartment and ash tray assembly openings remove four attaching screws.
8. Remove knee restraint.

BACK TO INDEX

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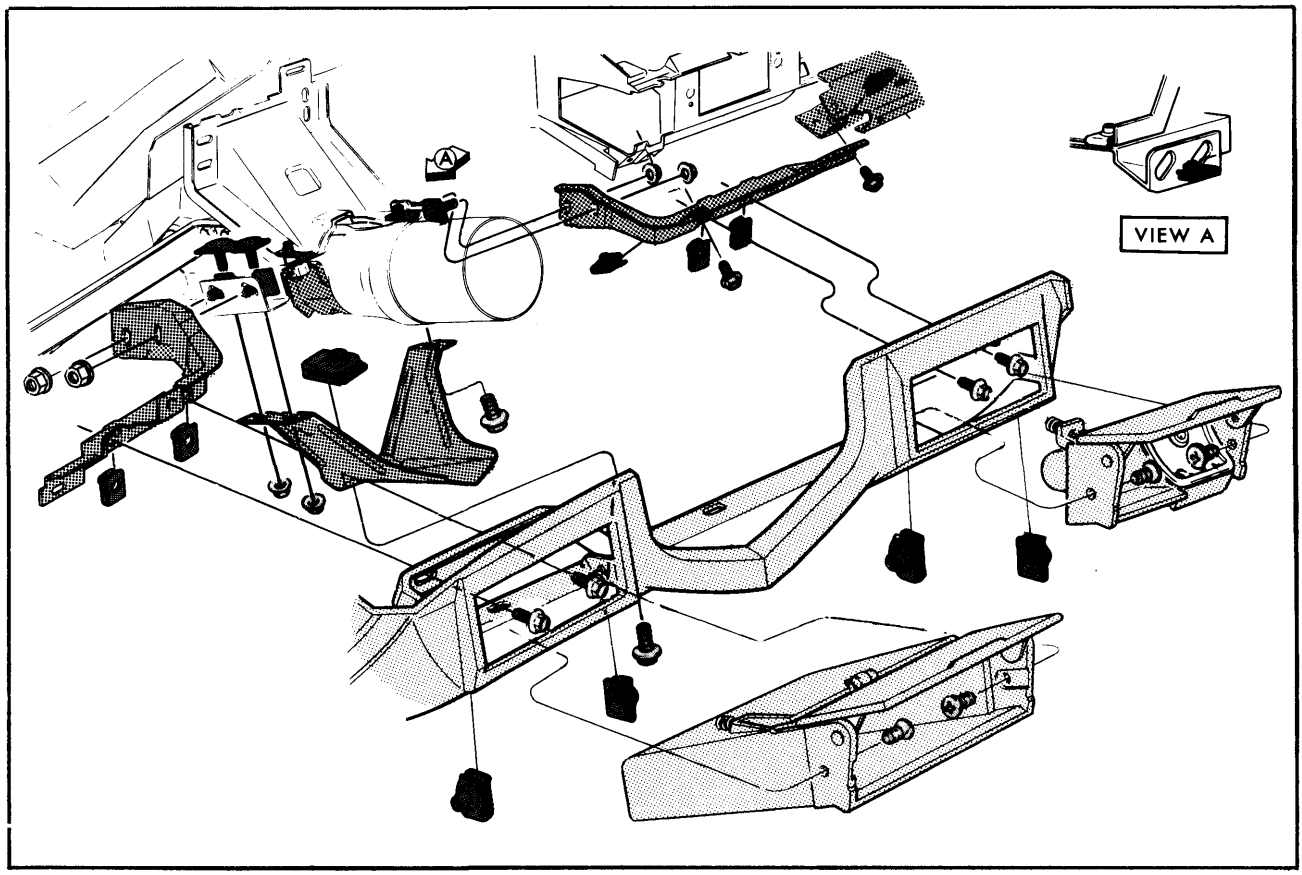


Fig. 12-70 A.C.R.S. Driver Knee Restraint

b. Installation

1. Position knee restraint and loosely install left hand trim screw and right lower edge screw.
2. Loosely install 4 upper and 3 remaining lower screws.
3. Hold knee restraint firmly in position and tighten left trim screw and all attaching screws.
4. Install tape storage compartment and secure with 2 screws.
5. Connect cigar lighter electrical connectors, position ash tray assembly into knee restraint and secure with 2 screws.
6. Install glove box as described in Note 101b.
7. Connect negative battery cable. Tighten to 70 inch pounds.

104. Tape Storage Compartment (Fig. 12-70)

a. Removal

1. Open tape storage compartment door and remove 2 screws.
2. Pull straight out and remove door and compartment as an assembly from driver knee restraint.

b. Installation

1. Position door and compartment assembly into driver knee restraint.
2. Install 2 screws and close tape storage compartment door.

105. Ash Tray Assembly (Fig. 12-70)

a. Removal

1. Disconnect negative battery cable and tape terminal end.
2. Open ash tray door and remove 2 screws securing ash tray assembly to driver knee restraint.
3. Pull ash tray straight out and disconnect lamp and base connector from cigar lighter.

b. Installation

1. Connect base connector and lamp to rear of cigar lighter.
2. Position ash tray and secure with 2 screws.
3. Connect negative battery cable. Tighten to 70 inch pounds.

106. Radio Receiver

a. Removal

1. Turn ignition switch to "lock" position. Disconnect negative battery cable and tape terminal end.
2. Remove knee restraint as described in Note 103a.
3. Remove nut from radio support on back of radio. Loosen radio support lower screw and pivot support out of way.

BACK TO INDEX

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4. Disconnect antenna.
5. Remove radio knobs, anti rattle springs, control rings and hex nuts.
6. Working through the knee restraint opening gently slide radio receiver from horizontal support and allow the back of the radio to lower enough to gain access to the three electrical connectors. The connectors are located on the back left hand side and are removed by depressing the lock tabs and pushing upward.
7. Pivot receiver slightly to the left to clear instrument panel support, slide toward front of car, lower dial and remove dial side first through knee restraint opening.

b. Installation

1. Carefully note the three electrical terminal positions and their locations to each other.
2. Slide receiver, back side first, through knee restraint opening. Rotate dial upward and position into horizontal support. Loosely install hex nuts.
3. Connect electrical connectors. Lock tab on the wide (front speaker) connector should face the dial. The other two face the engine.
4. While supporting receiver from bottom tighten hex nuts. Install control rings, anti rattle springs and radio knobs.
5. Pivot radio support into position and install nut onto stud on back of receiver. Tighten lower support screw.
6. Connect antenna.
7. Install knee restraint as described in Note 103b.
8. Install glove box as described in Note 101b.
9. Connect negative battery cable. Tighten to 70 inch pounds.

107, Radio Front Speakers

a. Removal

1. Disconnect negative battery cable and tape terminal end.
2. Remove instrument panel pad as described in Note 59a.
3. Remove clips securing air duct and push duct forward (left hand only).
4. Depress spring retainer and remove speaker.
5. If speaker is malfunctioning cut wires and remove.

b. Installation

1. Position speaker in top cover and secure with retainer spring.
2. Cut wires to proper lenght and splice into new speaker leads. Solder on crimp with solderless connector.
3. Install air duct and secure with clips (left hand only).
4. Install instrument panel pad as described in Note 59b.
5. Connect negative battery cable. Tighten to 70 inch pounds.

108. Right Hand Insert and Applique

a. Removal

1. Disconnect negative battery cable and tape terminal end.
2. Remove instrument panel pad as described in Note 59a.
3. Remove radio control knobs, anti rattle springs and left hex nut.
4. "Snap" electrical accessory switches from insert and disconnect map light connector.
5. Working through instrument panel pad opening remove screws that secure insert and applique to horizontal support.
6. Remove applique from horizontal support.

b. Installation

1. Position insert and applique onto horizontal support.
2. Install horizontal support to insert and applique attaching screws.
3. Connect accessory switch and map light electrical connectors.
4. Install left hex nut, control rings, anti rattle springs and radio knobs.
5. Install instrument panel pad as described in Note 59b.
6. Connect negative battery cable. Tighten to 70 inch pounds.

109. Right Hand Lower Trim Cover (Fig. 12-71)

a. Removal

1. Turn ignition switch to "lock" position. Disconnect negative battery cable and tape terminal end.
2. Remove glove box as described in Note 101a.
3. Remove knee restraint as described in Note 103b.
4. Remove instrument panel pad as described in Note 59a.
5. Remove R.H. insert and applique as described in Note 78a.
6. Remove 6 trim cover upper attaching screws through openings in the horizontal support.
7. Remove right hand trim screw.
8. Remove left hand trim cover to knee restraint brace screw.
9. Pull top of R.H. lower trim cover from horizontal support and unhook it from the air cushion restraint assembly lower edge.

b. Installation

1. Hook R.H. lower trim assembly onto air cushion restraint assembly and insert top edge between the horizontal support and reinforcement.
2. Install 8 attaching screws.
3. Install R.H. insert and applique as described in Note 78b.
4. Install instrument panel pad as described in Note 59b.
5. Install knee restraint as described in Note 103b.
6. Install glove box as described in Note 101b.
7. Connect negative battery cable. Tighten to 70 inch pounds.

BACK TO INDEX
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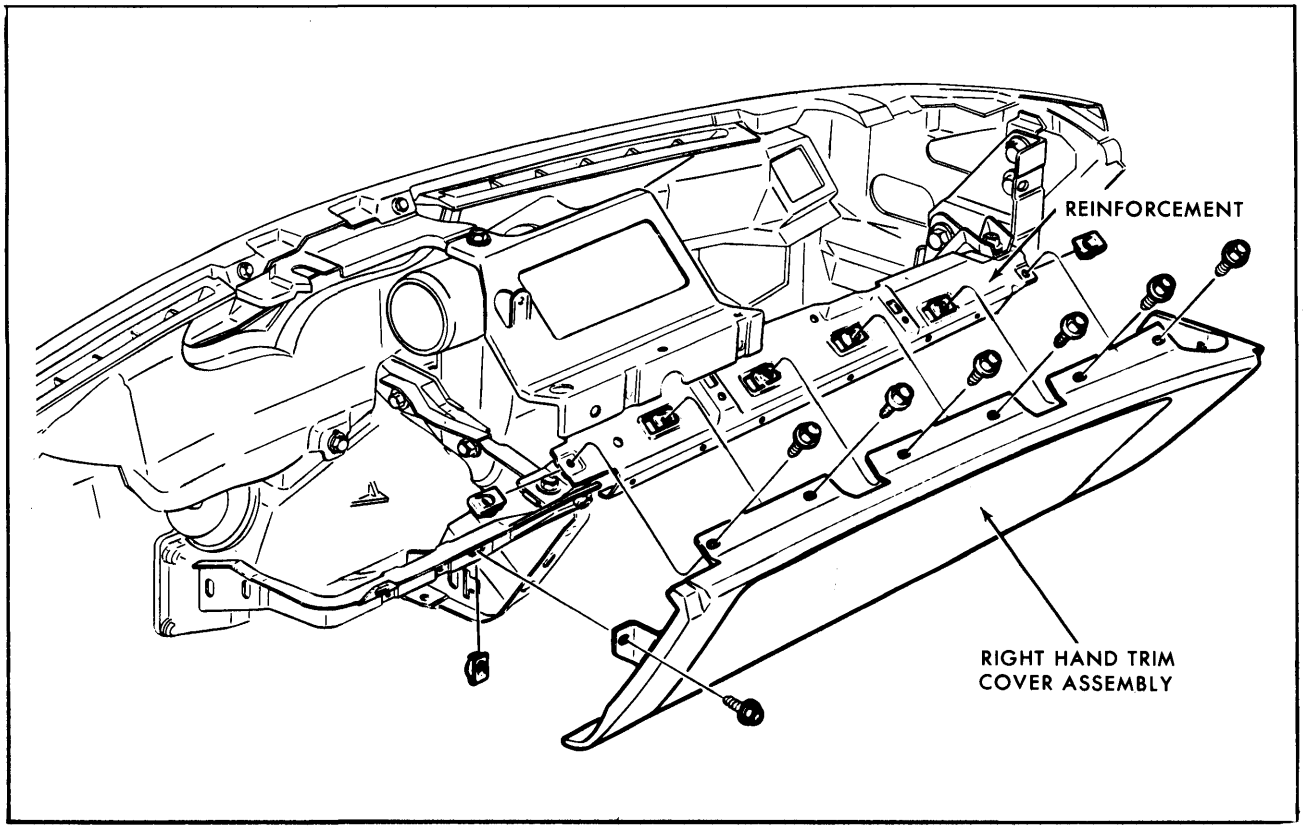


Fig. 12-71 A.C.R.S. Passenger Restraint Trim Cover

110. Theft Deterrent Controller

a. Removal

1. Disconnect negative battery cable and tape terminal end.
2. Remove instrument panel pad as described in Note 59a.
3. Disconnect theft deterrent controller electrical connector.
4. Remove screw that secures controller underside to center climate control outlet support.

b. Installation

1. Install controller to underside of center climate control outlet support with attaching screw.
2. Connect theft deterrent controller electrical connector.
3. Install instrument panel pad as described in Note 59b.
4. Connect negative battery cable. Tighten to 70 inch pounds.

111. Track Master Controller

a. Removal

1. Disconnect negative battery cable and tape terminal end.
2. Remove instrument panel pad as described in Note 59a.
3. Disconnect electrical connectors from forward side of controller.
4. Loosen two support screws.
5. Slide controller upward and remove.

b. Installation

1. Position controller and mounting screws and tighten screws.
2. Connect electrical connectors to the forward hand side of the controller.

(NOTE: The connectors are not interchangeable. The connector toward the left of the car is notched.)

3. Install instrument panel pad as described in Note 59b.
4. Connect negative battery cable. Tighten to 70 inch pounds.

BACK TO INDEX

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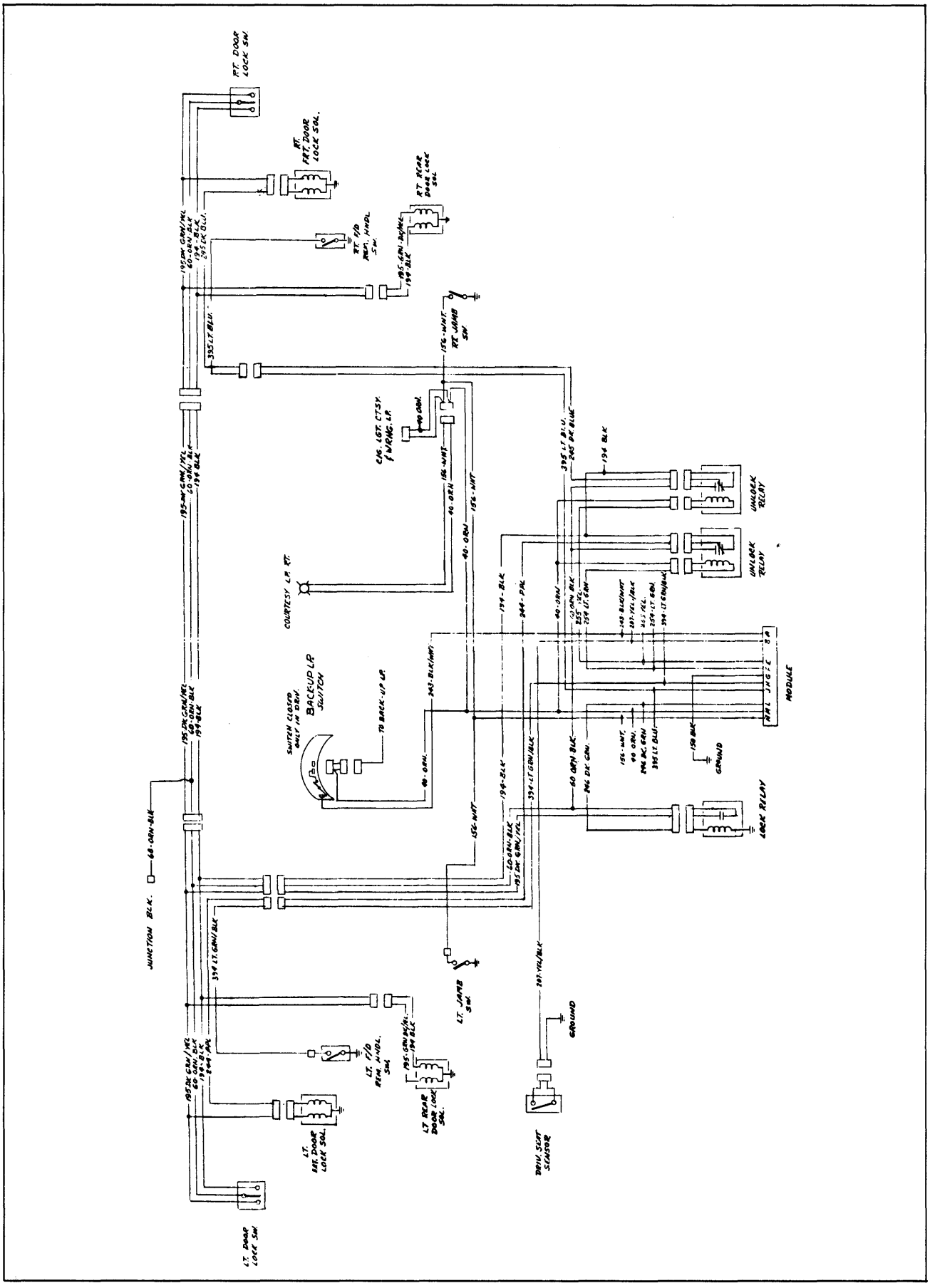


Fig. 12-72 Automatic Door Locks Wiring Circuit Diagram

BACK TO INDEX

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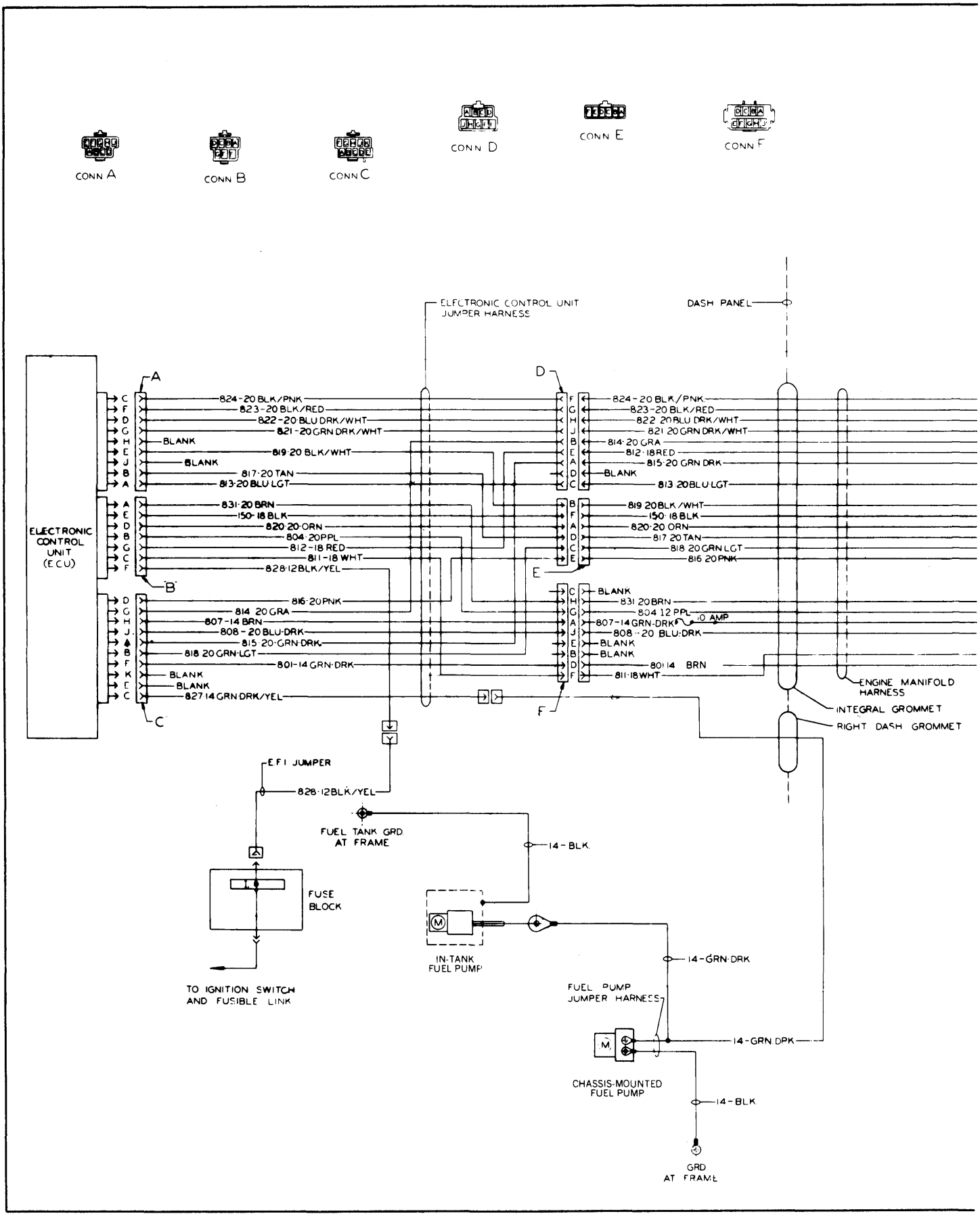


Fig. 12-73 Electronic Fuel Injection Wiring Circuit Diagram

BACK TO INDEX

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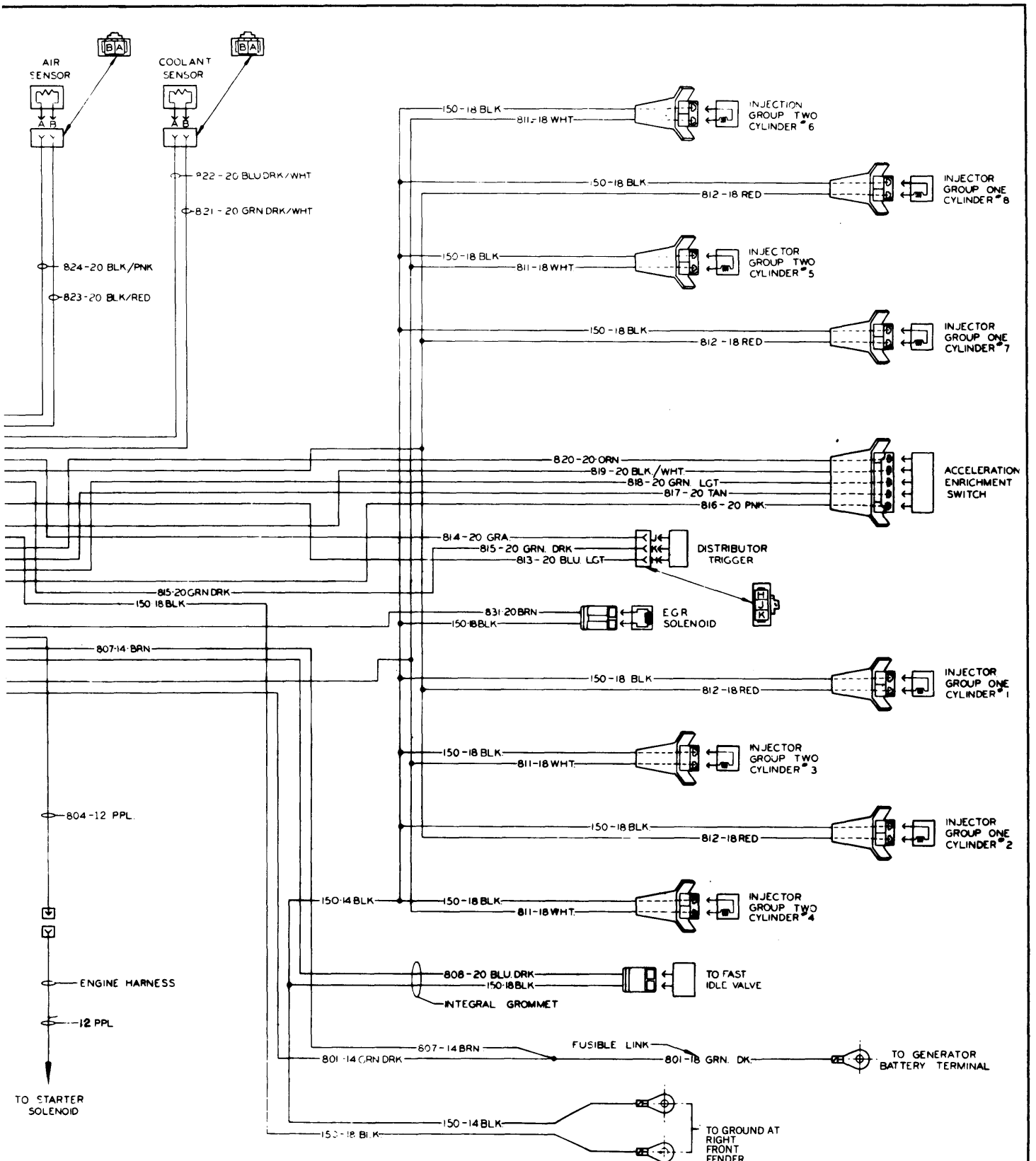


Fig. 12-73 Electronic Fuel Injection Wiring Circuit Diagram

BACK TO INDEX

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LIGHTING AND CHASSIS ELECTRICAL TORQUE SPECIFICATIONS

Material	Application	Size	Inch Pounds
6010M	Antenna Mast Tube Bracket to Fender Screws	10–16 TS	30
Special	Antenna Lower Support to Motor Housing Screw	1/4–20	65
275M	Antenna Lower Support Bracket to Wheelhouse	5/16–18	18*
6010M	Antenna Relay to Toe Pan Screws	8–18 TS	25
1010	Back Up Lamp to Body Screws – "E"	1/4–20	60
Stainless	Cornering Lamp to Fender Screws "C"	8–18 TS	15
1010	"E"	1/4–20	60
275M	Cornering Lamp Mounting Bracket to Fender – "C"	1/4–20	75
6010M	Fuel Economy Switch to Cowl Screw	1/4–14 TS	60
6010M	Fuse Block to Cowl Screws	10–16 TS	25
1010	Grille Extension Molding to Headlamp Housing – "E"	10–24	20
6010M	Guide-Matic Relay to Cowl	1/4–14 TS	25
Stainless	Headlamp Bezel Attaching Screws	8–18 TS	15
275M	Headlamp Housing Attaching Screws	1/4–20	75
1050	Headlamp Housing Molding Attaching Nuts – "C"	3/16	25
6010M	Horns and Horn Mounting Bracket Screws	5/16–12	22*
1050	Lamp Monitor Housing to Fender Nuts – "C"	3/16	12
	– "E"	3/16	12
1050	Lamp Monitor Lens to Housing Nut	5/32	
1010	License Lamp to Mounting Bracket – "E"	10–24	25
260M	Park Lamp Housing to Bumper Bracket – "E"	3/8–16	18*
1010	Rear Defogger Relay and Circuit Breaker	8–32	15
Stainless	Rear Side Marker Lamp Attaching Screw – "C"	8–18 TS	18
Stainless	– "E"	8–32	18
Stainless	Reflex attaching Screw – "E"	8–32	18
6010M	Tail Lamp Bezel to Body Screw	8–18 TS	15
Stainless	Tail Lamp Escutcheon to Tail Lamp Screw – "E"	8–18 TS	15
1010	Tail Lamp and Mounting Bracket Screws	1/4–20	60
1010	Theft Deterrent Controller to Support	10–24	25
6010M	Washer Fluid Bottle Bracket to Cowl	1/4–14 TS	45
6010M	Washer Nozzle Attaching Screw	10–16 TS	18

TS – Self Tapping Screw

* – Foot Pounds

AIR CUSHION RESTRAINT SYSTEM INSTRUMENT PANEL TORQUE SPECIFICATIONS

6010M	Ash Tray and Stowage Compartment Screws	8–18 TS	15
275M	Driver Knee Restraint – Upper	1/4–20	75
6010M	– Lower Outer	1/4–20 TS	75
280M	– Lower Center(1)	1/4–20	75
6010M	Glove Box Attaching Screws	10–16 TS	25
6010M	Passenger Restraint Cover – Upper and Left	8–18 TS	25
1010	Radio Rear Support Rod Lower Screw	10–24	25

TS-Self Tapping Screw

BACK TO INDEX

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INSTRUMENT PANEL
TORQUE SPECIFICATIONS

Material	Application	Size	Inch Pounds
1022	A/C Outlet Door to I.P. Pad Screws	10–16 HL	20
1022	Accessory Switch Housing to R.H. Insert and Applique	10–16 HL	20
6010M	Ash Tray L.H. and Lower Attaching Screws	10–16 TS	18
1022	Ash Tray R.H. Bracket to R.H. Lower I.P.	10–16 HL	20
6010M	Ash Tray Door Attaching Screws	10–16 TS	18
1010	Ash Tray "L" Bracket to I.P. or Ash Tray	10–24	25
6010M	Climate Control, Cruise Control and Headlamp Switch Housing to Horizontal Support	10–24 TS	35
6010M	Climate Control Bracket to Control Head Screw	10–24 TS	25
275M	Center Supports Attaching Screws	5/16–18	18*
275M	Fuel Injection ECU Attaching Screws	1/4–20	75
6010M	Fuel Injection ECU Mounting Bracket to Cowl	1/4–14 TS	60
6010M	Glove Box Liner Attaching Screws	8–18 TS	15
1010	Glove Box Hinge to Hinge Support	10–24	25
6010M	Glove Box Hinge to Glove Box Door	10–24 TS	15
Special	Glove Box Lock Case Escutcheon		45
1010	Glove Box Striker Attaching Screws	10–24	25
6010M	Glove Box Door Support Cable Screws	8–18 TS	15
6010M	Glove Box Door Inner to Outer Halves	10–18 TS	15
Special	Headlamp Switch Sleeve to Switch or Backplate	7/16–28	45
275M	Horizontal Support to Body Brackets	5/16–18	18*
284M	I.P. Pad Attaching – Right and Center Nuts	10–24	30
1010	– Left Screw	10–24	25
6010M	– Lower Screws	10–16 TS	25
6010M	I.P. Pad, A/C Duct to Pad – Upper and Lower	8–18 TS	18
1022	– Right Screw	10–16 HL	20
1022	– Left Screw	10–16 HL	20
286M	I.P. Top Cover Attaching – Center Foreward Nut	1/4–20	50
6010M	– Side Trim Screws	8–18 TS	14
286M	– Underside Studs	10–24	35
6010M	L.H. Insert Attaching Screws – Upper	10–16 TS	18
1010	– Lower	10–24	25
1010	Lower Steering Column Cover to Support – Upper	10–24	18
6010M	– Lower	10–24 TS	35
275M	Lower Steering Column Cover Reinforcement	1/4–20	75
1050	Mirror, R.H. Control Nut	3/4–20	60
1010	Mirror, R.H. Control Bracket Attaching Screw	10–24	35
1022	R.H. Insert and Applique Attaching Screws	10–16 HL	20
275M	R.H. Lower I.P. to Lower Support Screws	5/16–18	18*
1010	R.H. Lower I.P. to Horizontal Support	10–24	25
1010	Radio Control Thin Hex Nuts	7/16–28	60
284M	Radio Rear Support Rod to Radio Nut	10–24	25
1010	Radio Rear Support Rod to I.P. Reinforcement	10–24	25
6010M	Speedometer Cluster to Horizontal Support	10–24 TS	35
1010	Speedometer Cluster Bezel Attaching Screws	10–24	25
1022	Telltale Housing, Clock, Climate Control Outlet Ducts and In-Car Sensor to I.P. Top Cover Screws	10–16 HL	20
1010	Windshield Wiper Switch Mounting Screw	10–24	20

TS – Self Tapping Screw
HL – HiLo Thread Diameter
*Foot Pounds
For HiLo applications a #11 – 16 (oversize) screw is available for repair purposes (1600491 or equivalent)

BACK TO INDEX

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BACK TO INDEX

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WARNING: IF EQUIPPED WITH AIR CUSHION RESTRAINT SYSTEM DO NOT ATTEMPT ANY ADJUSTMENT, REPAIR OR REMOVAL OF THE FRONT BUMPER OR COMPONENTS UNTIL THE DISCONNECTION PROCEDURE IS COMPLETED. THIS PROCEDURE MUST BE FOLLOWED TO PREVENT ACCIDENTAL DEPLOYMENT OF THE SYSTEM WHICH COULD RESULT IN PERSONAL INJURY AND/OR DAMAGE TO THE SYSTEM'S COMPONENTS. IN ADDITION, CARE MUST BE EXERCISED TO NEVER BUMP OR STRIKE THE BUMPER IMPULSE DETECTOR IN A MANNER WHICH COULD CAUSE INADVERTENT DEPLOYMENT OR IMPROPER OPERATION OF THE SYSTEM.

A.C.R.S. DISCONNECTION PROCEDURE

1. Turn ignition switch to "LOCK" position. Disconnect the negative battery cable from the battery and tape end.
2. If removing or replacing front bumper, remove bolts from bumper impulse detector to bumper impulse detector bracket and tape impulse detector to radiator support until bumper work is completed.
3. Inspect impulse detector for any visual damage to case or mounting. If damaged – replace assembly.
4. Inspect wiring harness for chaffing, cuts or any visible damage. DO NOT ATTEMPT ANY REPAIR OF HARNESS. If damaged – replace assembly.

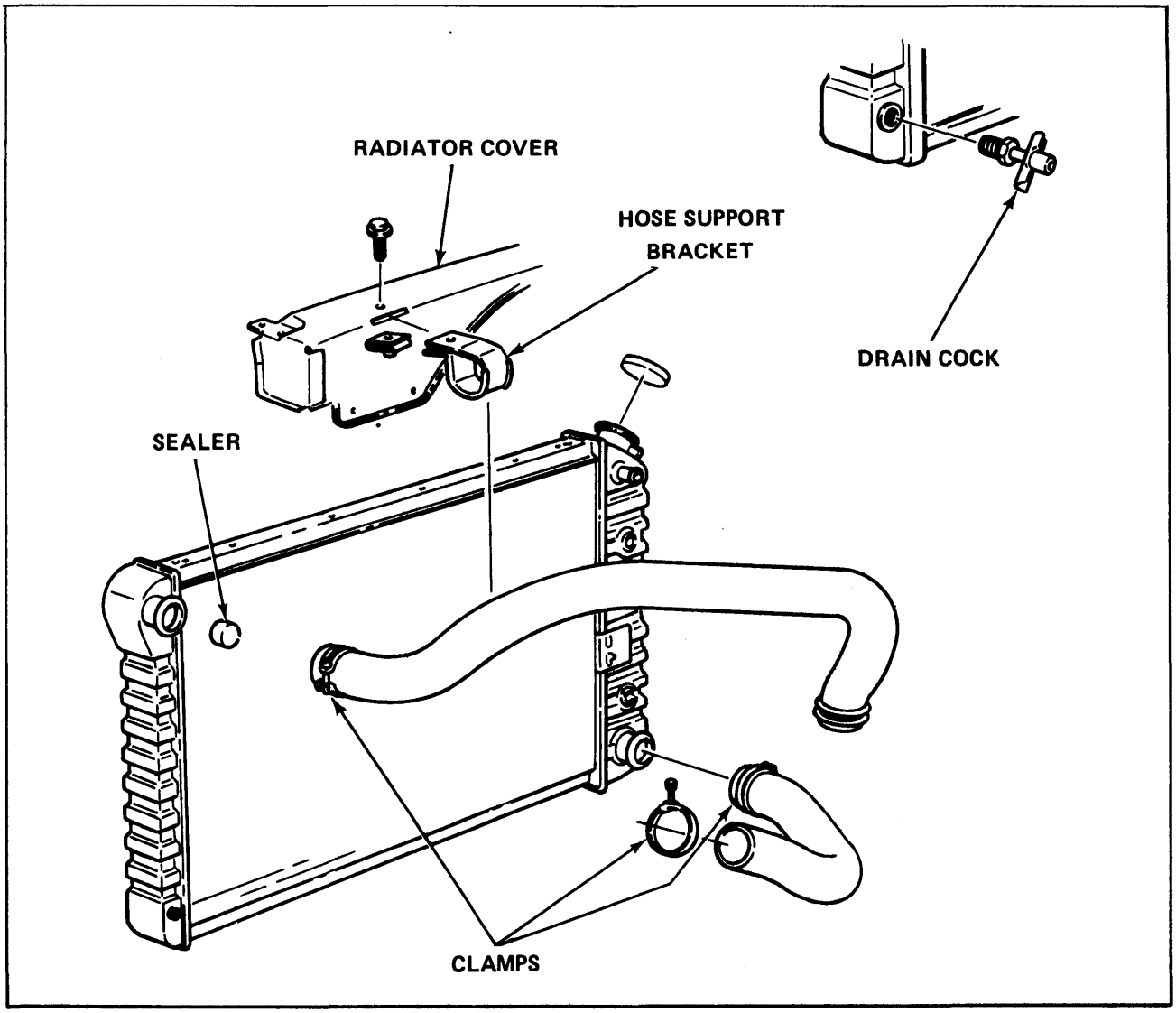


Fig. 13-1 Radiator Assembly and Hoses

BACK TO INDEX

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GENERAL DESCRIPTION

Radiator

A crossflow radiator, Fig. 13-1, is used as part of the engine closed cooling system. The radiator is constructed with two vertical tanks that connect to the enclosed crossflow tubing. The radiator filler neck, vented pressure cap, and coolant reservoir tube are located on the corner of the right tank.

A radiator coolant reservoir is located to the left of the radiator. Service information pertaining to the reservoir is covered in Section 6, Note 4.

The following radiator codes are used:
Standard Radiator (All except H.D. Cooling and Limousine) – Code AA.
Heavy Duty Radiator (All with H.D. Cooling and Limousine) – Code AC.

The heavy duty radiator on (option VO 1), Seventy-Five series cars and the Commercial Chassis has added copper in the core and a three plate transmission oil cooler in the outlet tank.

Radiator Cradle (Figs. 13-2 and 13-3)

All radiator cradles have an integral fan shroud, and trays on the left and right sides of the radiator to mount the reservoir bottle and the battery, respectively. A support rod at the center, between the tie bars, adds ridigity in the hood lock area.

Radiator Cradle Mounts

All cars except the Eldorado use three radiator cradle mounts, Fig. 13-4. The inboard mount attaches directly to the frame front cross member. The two outboard mounts are fastened to the trays on either side of the radiator and are supported by adjustable brackets fastened to the Energy Absorber mounting brackets, Fig. 13-4.

The Eldorado employs two radiator cradle mounts. The mounts fasten to special mounting brackets which, in turn, are fastened to the frame front cross member by two bolts, rubber bushings, nuts, and washers, Fig. 13-5.

Grille

The grille is of chrome plated, injection-molded plastic construction. Both upper and lower grilles are mounted to the bumper and travel with the bumper during compression and rebound strokes of the Energy Absorbing units. Mounting provisions for the upper and lower grilles are independent of each other so that either portion may be removed without disturbing the other.

BACK TO INDEX

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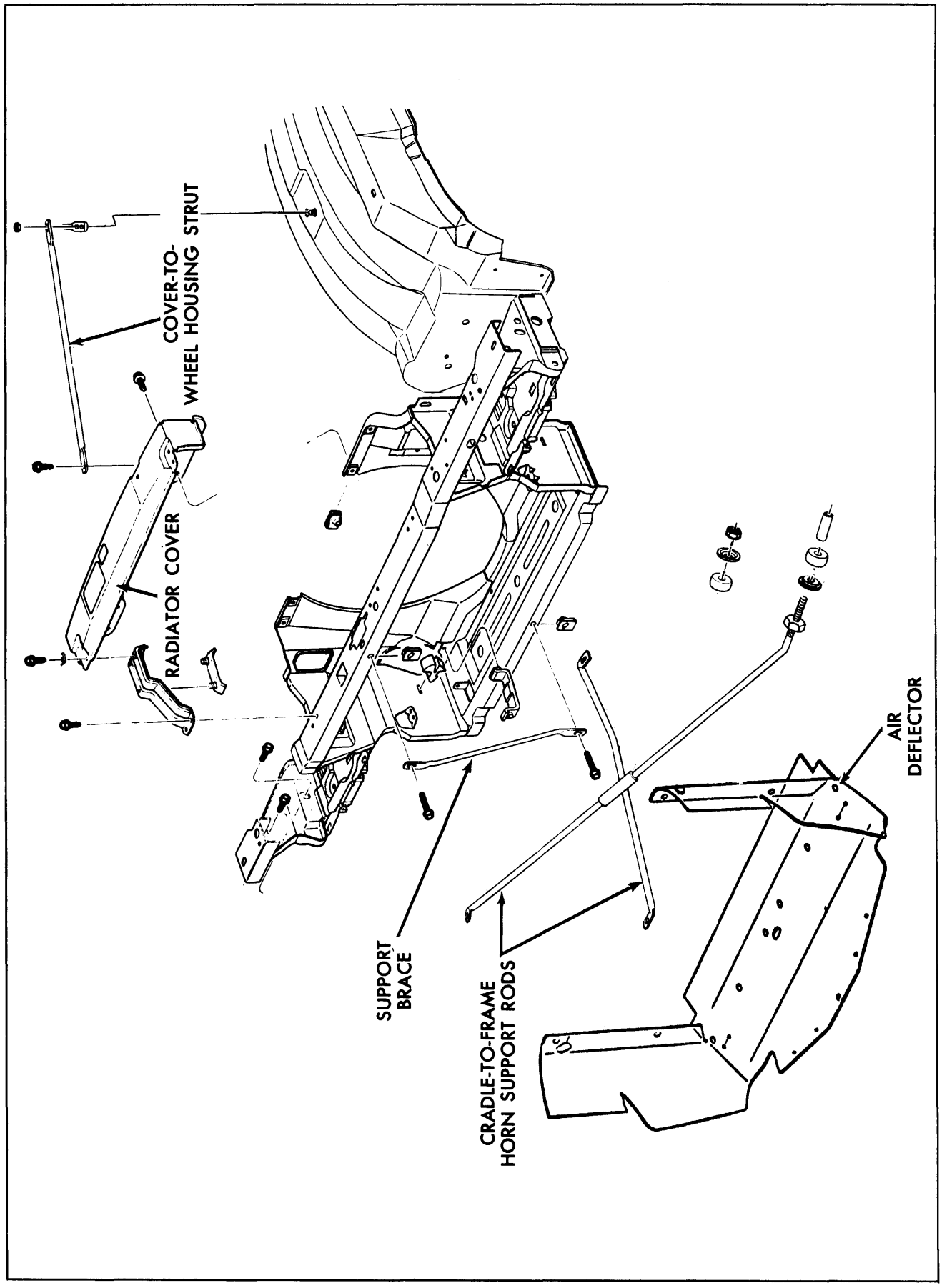


Fig. 13-2 Radiator Cradle Assembly—Except Eldorado

BACK TO INDEX

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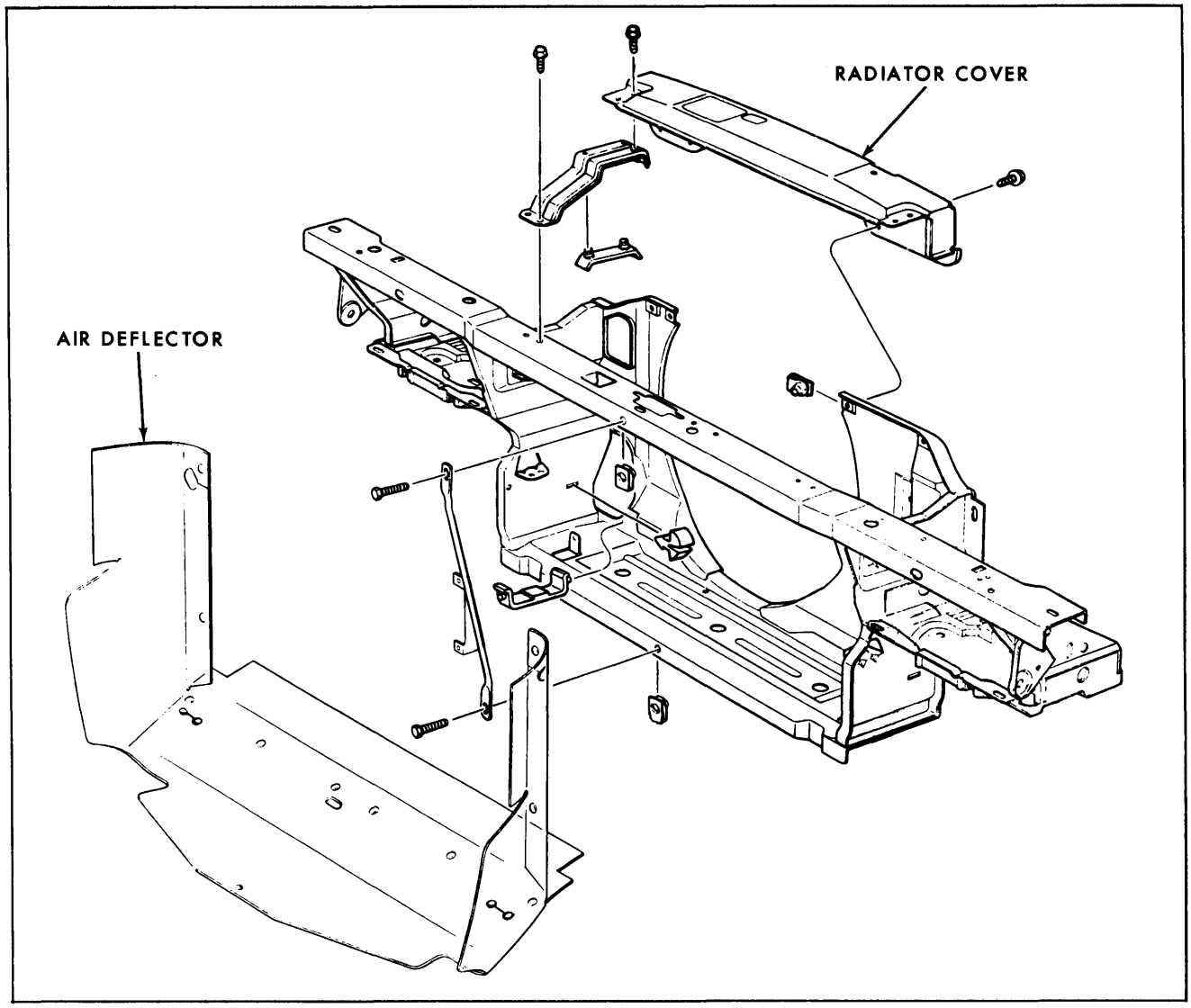


Fig. 13-3 Radiator Cradle Assembly—Eldorado

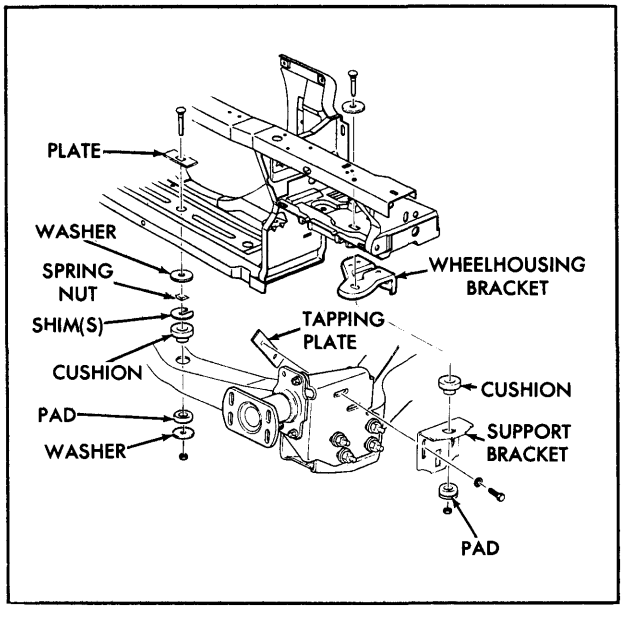


Fig. 13-4 Radiator Cradle Mounts—Except Eldorado

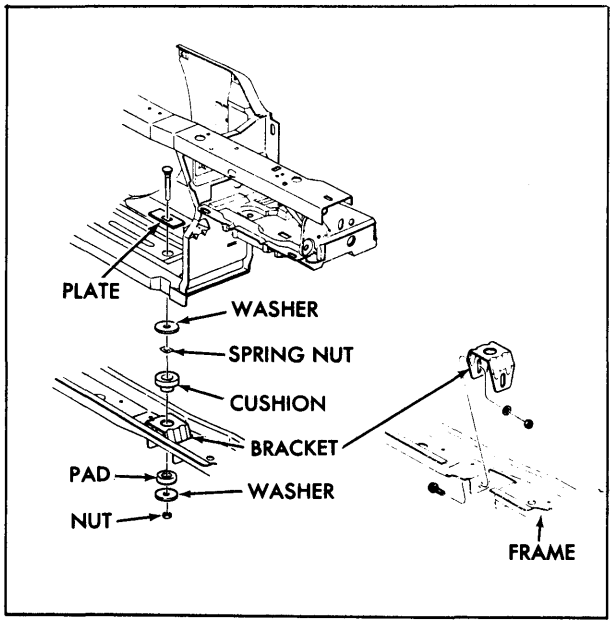


Fig. 13-5 Radiator Cradle Mounts—Eldorado

BACK TO INDEX

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SERVICE INFORMATION

1. Radiator

a. Removal

1. Disconnect negative battery cable.
2. Place drain pan under radiator and open drain cock at bottom left corner of radiator. Remove radiator cap so coolant will flow freely.
3. Loosen hose clamps and disconnect upper and lower radiator hoses at radiator.
4. Loosen clamp and disconnect heater return hose at right radiator tank.
5. Disconnect two transmission cooler lines at transmission fluid cooler tank on right side of radiator. Plug all openings to prevent loss of fluid.
6. Remove one screw securing upper radiator hose clamp to radiator cover panel.
7. Remove six screws securing radiator cover panel and remove panel.
8. Remove reservoir hose from filler neck and two straps from top of radiator and position hose out of way.
9. Being careful not to damage radiator, remove radiator by lifting straight up.

b. Installation

1. Carefully lower radiator into position in cradle.
2. Connect reservoir hose to filler neck and install two straps at top of radiator, securing with four screws.
3. Install radiator cover panel and secure with six screws.
4. Install one screw securing upper radiator hose clamp to cover panel.
5. Connect two transmission cooler lines at transmission fluid cooler tank on right side of radiator, tightening to 20 foot-pounds.
6. Connect upper and lower radiator hoses at radiator and secure with hose clamps.
7. Connect heater return hose to right radiator tank.
8. Close radiator drain cock, and fill cooling system with recommended coolant.
9. Connect negative battery cable.
10. Set Automatic Climate Control to "DEF" position and rotate temperature dial to 85°. If car is equipped with heater only, set controls in maximum heat position.

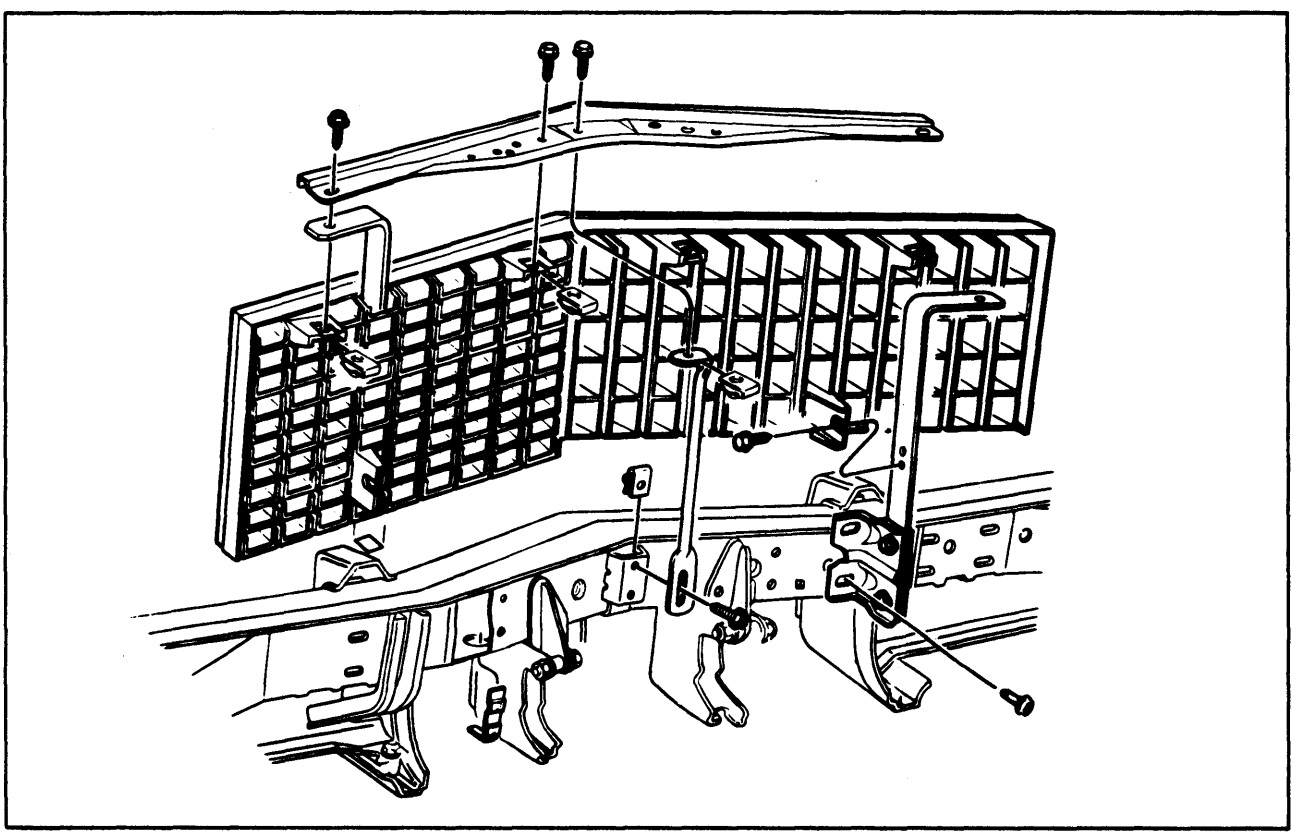


Fig. 13-6 Upper Grille Assembly

BACK TO INDEX

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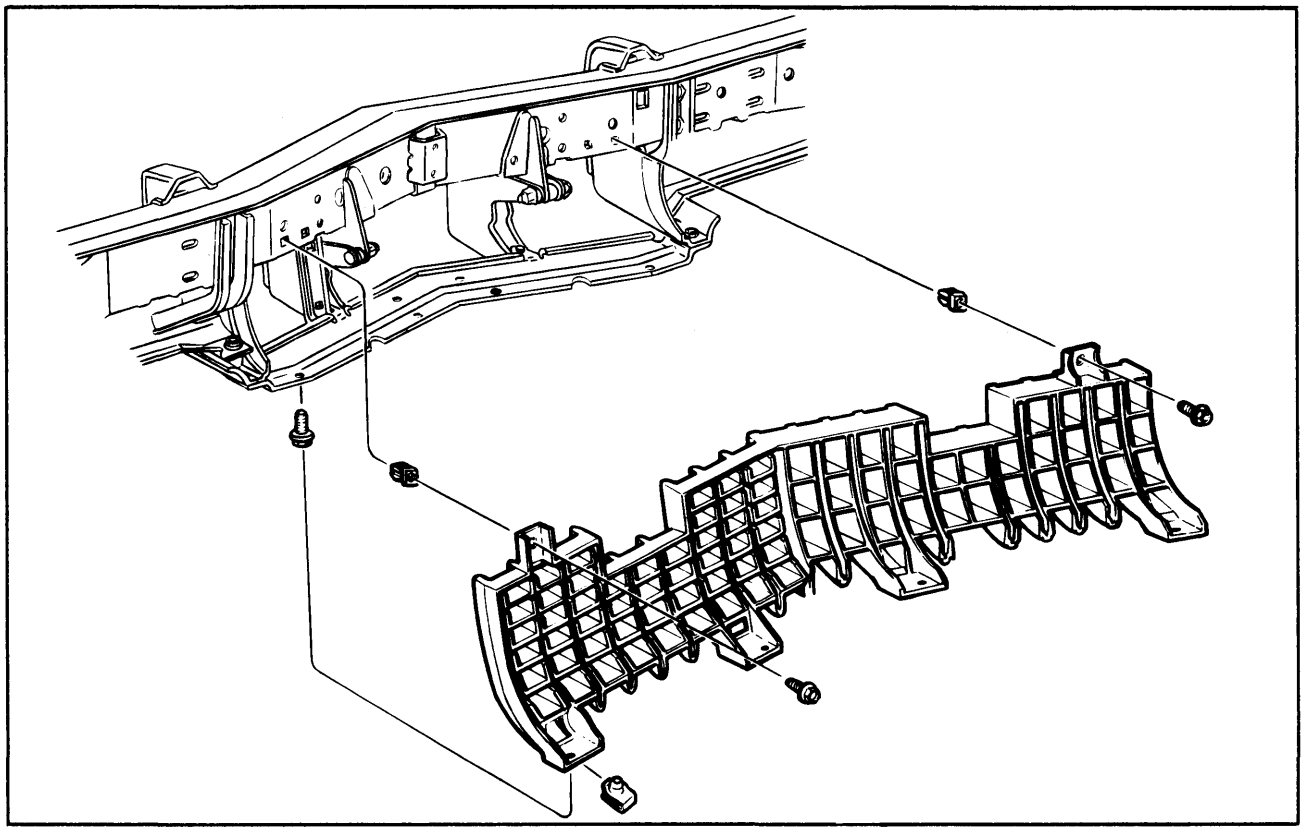


Fig. 13-7 Lower Grille Assembly

11. Run engine sufficiently to pump coolant through entire system and check radiator and transmission for fluid levels.
12. Install radiator cap and check all connections for leaks.

2. Radiator Cradle Mounts

a. Inboard Mounts

The actual number of shims used may vary with each installation. Use the quantity necessary to fill the gap remaining between the cradle and frame after the mounting pads are installed and the sheet metal aligned. The correct number of shims required may be determined by attempting to rotate the pad between the cradle and the frame. If the pad can be rotated with the fingers, add shims until pad can no longer be rotated.

b. Outboard Mounts

The cradle support brackets adjust vertically on the EA brackets via slotted holes; therefore, no shims are required. Although three slots are provided, only two screws and washers and one tapping plate are used. Third hole makes bracket interchangeable between left and right side of car.

3. Upper Grille (Fig. 13-6)

a. Removal

1. Open hood.
2. If car is equipped with Guide-Matic, remove two screws securing Guide-Matic photo amplifier to grille and one screw securing bottom of strut rod to center bumper bar.
3. Remove two screws securing each end of grille to upper grille reinforcement.
4. Loosen one screw securing each of two rear grille mounting tabs to vertical grille supports.
5. Remove one screw securing center support rod to center bumper bar.
6. Taking care not to damage bumper, slide grille forward until disengaged from supports and reinforcement, then lift straight up.

b. Installation

1. Install U-nuts on four upper attaching lugs on grille.
2. Slide grille carefully into position to avoid scratching bumper. Engage slots in rear grille mounting tabs with retaining screws on grille supports and line up screw holes in grille upper lugs with holes in grille upper reinforcement.

BACK TO INDEX

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3. Insert two screws securing each end of grille reinforcement, tightening to 30 inch-pounds.
4. Tighten screws securing grille tabs to left and right supports to 30 inch-pounds.
5. Install one screw securing center support rod to center bumper bar.
6. If car is equipped with Guide-Matic, position photoamplifier and strut rod to center Bumper Bar and secure with three screws.
7. Close hood and check alignment of grille. Readjust as required.

4. Lower Grille (Fig. 13-7)

a. Removal

1. Remove fasteners securing air deflector to lower center bar.
2. Remove four bolts securing lower grille to lower center bar.
3. Remove two screws securing lower grille to bumper upper center bar.
4. Pull grille straight back then tip one end up and drop grille straight down and out of car.

b. Installation

1. Lift lower grille into position and secure to bumper upper center bar with two screws, tightening to 30 inch-pounds.
2. Install four bolts between lower center bar and grille. Tighten to 18 inch-pounds.
3. Allow air deflector to rest on lower center bar and secure to lower center bar with fasteners.

TORQUE SPECIFICATIONS

Material No.	Application	Thread Size	Torque
275M/1050-65	Lower Grille Angle Bracket to Lower Center Bar Screws	1/4-20	60 in. lb.
275M/1050-65	Angle Bracket to Lower Grille Screws	1/4-20	30 in. lb.
6010M/1008	Lower Grille to Bumper Center Bar Screws	1/4-14	30 in. lb.
275M	Upper Grille Reinforcement to Upper Grille Screws	1/4-20	30 in. lb.
6010M/1050-65	Upper Grille Reinforcement to Support Screws	1/4-20	60 in. lb.
275M	Upper Center Support Rod Screws	1/4-20	60 in. lb.
6010M/1050-65	Upper Grille Support Angle Bracket Screws	1/4-20	60 in. lb.
275M/1050-65	Lower Center Support Rod Screws	5/16-18	18 ft. lb.
286M	Radiator Cradle Mount Nuts	7/16-14	30 ft. lb.
280M	Radiator Cradle Outer Mounting Bracket to EA Bracket	3/8-16	30 ft. lb.
286M	Bumper Outer End Support Rod Nut Eldorado, "75" and Commercial	3/8-16	18 ft. lb.
275M/1050	Radiator Cradle Cross Rod Screws	5/16-18	18 ft. lb.
275M/1050-65	Radiator Cradle Center Support Rod Screws	5/16-18	18 ft. lb.
6010/1050-65	Radiator Cover Strut Rod Screw	5/16-18	18 ft. lb.

BACK TO INDEX

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GENERAL DESCRIPTION

WARNING: IF EQUIPPED WITH AIR CUSHION RESTRAINT SYSTEM DO NOT ATTEMPT ANY ADJUSTMENT, REPAIR OR REMOVAL OF THE FRONT BUMPER OR COMPONENTS UNTIL THE DISCONNECTION PROCEDURE IS COMPLETED. THIS PROCEDURE MUST BE FOLLOWED TO PREVENT ACCIDENTAL DEPLOYMENT OF THE SYSTEM WHICH COULD RESULT IN PERSONAL INJURY AND/OR DAMAGE TO THE SYSTEM'S COMPONENTS. IN ADDITION, CARE MUST BE EXERCISED TO NEVER BUMP OR STRIKE THE BUMPER IMPULSE DETECTOR IN A MANNER WHICH COULD CAUSE INADVERTENT DEPLOYMENT OR IMPROPER OPERATION OF THE SYSTEM.

A.C.R.S. DISCONNECTION PROCEDURE

1. Turn ignition switch to "LOCK" position. Disconnect the negative battery cable from the battery and tape end.

(NOTE: For additional information pertaining to Eldorado bumpers, refer to the latter portion of this section.)

The Cadillac front bumper assembly, Fig. 14-1, consists of ten pieces: a center bar, two removable bumper guards, two lower license guards, a lower center bar, and upper and lower outer ends on each side. Impact strips on the center bar, bumper guards, and upper outer ends protect the assembly.

Cadillac passenger car bumpers are designed so that the vehicle can withstand a collision into a fixed barrier (at 5 mph) without damage. After absorbing the energy of the collision the bumpers restore themselves to their original position.

The absorbing capability for both front and rear bumper systems is achieved through two energy absorbing devices in each bumper. These units convert the energy of an impact into heat and restoration.

The Energy Absorbing Device consists of two main sub-assemblies; the piston tube assembly and the cylinder tube assembly, Fig. 14-2. The piston tube assembly is filled with an inert gas under pressure and consists of a bumper bracket, piston tube, orifice, seal,

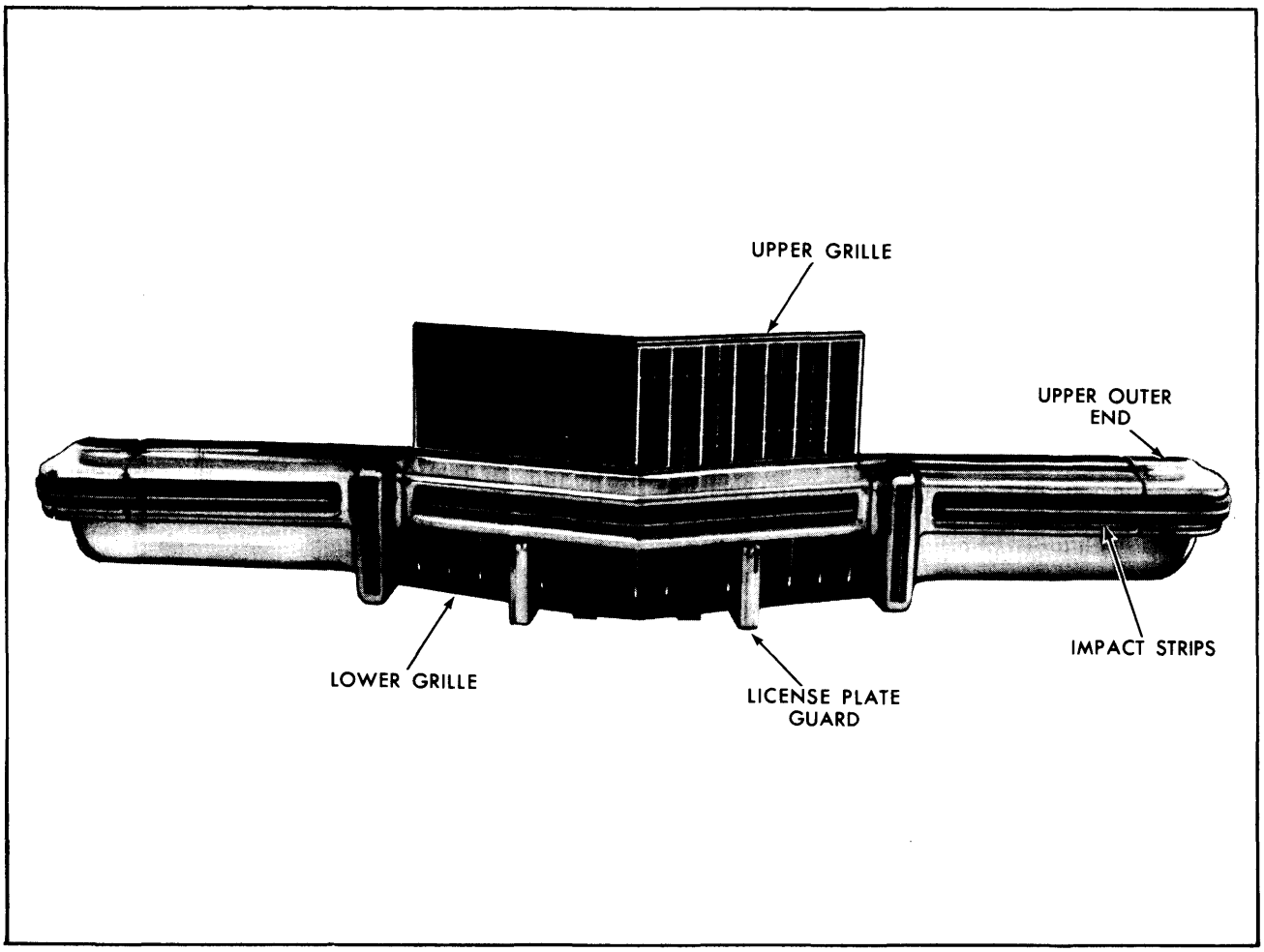


Fig. 14-1 Front Bumper Assembly—Except Eldorado

BACK TO INDEX

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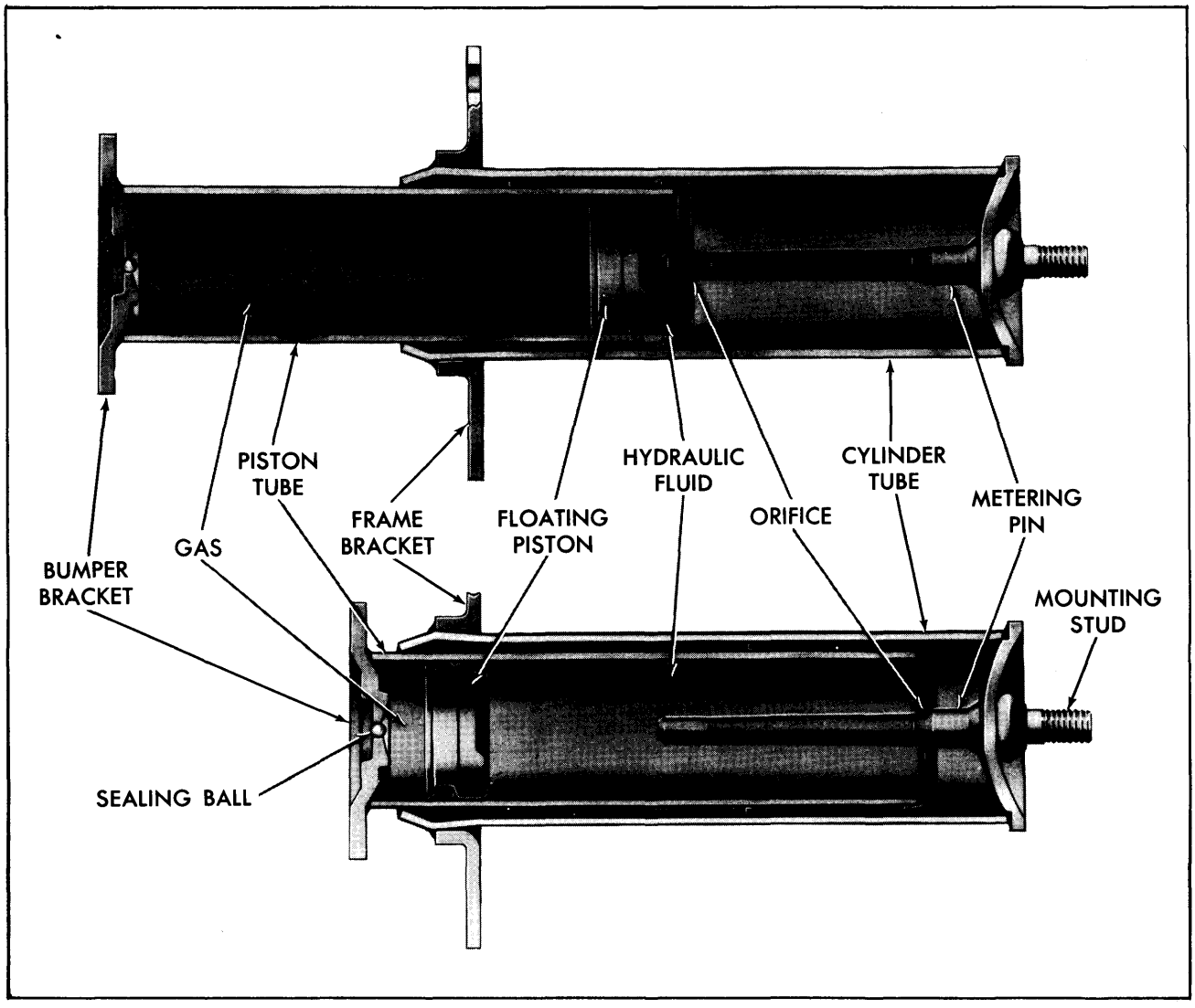


Fig. 14-2 Energy Absorbing Device Extended and Collapsed

piston seal, piston, and stop-ring. The cylinder tube assembly is filled with a hydraulic fluid and consists of a frame bracket, cylinder tube, mounting stud, and metering pin.

The piston tube assembly is inserted in the cylinder tube assembly and the cylinder tube is crimped. This crimp mates with the stop-ring to hold the unit together. The recess in the stop-ring area is filled with grease to prevent the entrance of water and other contaminating materials.

The gas pressure in the piston tube assembly maintains the unit in an extended position. Extension is limited by the stop-ring on the outside of the piston tube engaging the matching contour of the crimp on the cylinder tube as shown in Fig. 14-3. This engagement is also intended to provide extra rigidity to withstand jacking and towing stresses.

Upon impact, as the energy absorber is collapsed, the hydraulic fluid in the cylinder tube is forced into the piston tube through the orifice, Fig. 14-2. The metering pin controls the rate at which this fluid passes from the cylinder tube through the orifice and into the piston

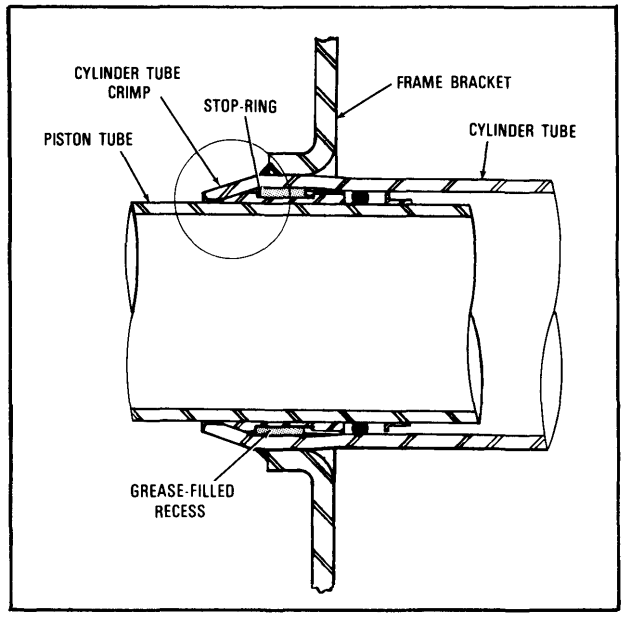


Fig. 14-3 Energy Absorber Crimp Area

BACK TO INDEX

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tube. This controlled passage of the fluid provides the energy absorbing action.

The hydraulic fluid that is forced from the cylinder tube into the piston tube displaces the floating piston, compressing the gas behind the floating piston. After impact, the pressure of the compressed gas behind the floating piston forces the hydraulic fluid back into the cylinder tube assembly extending the unit to its normal position.

A thin film of fluid on the energy absorber piston tube is a normal condition and does not require replacement of the unit.

Also attached to the bumper is a two piece grille that travels with the bumper when it absorbs an impact. Attachment to the frame is made by means of the Energy Absorbing Devices and their mounting brackets, Fig. 14-4.

On all cars, except Eldorado, two rubber mounted support rods extend downward from the fender reinforcement to a tab on the front bumper outer ends.

On Eldorado two rubber mounted support rods extend downward from the fender catwalk reinforcement to support brackets that attach to the front bumper upper outer ends.

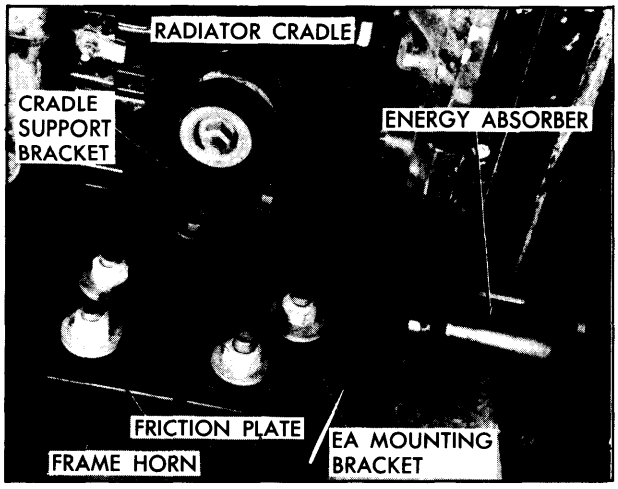


Fig. 14-4 Energy Absorber and Mounting Bracket

The rear bumper consists of one main bar with detachable outer ends. All rear side markers are attached to the bumper ends, Fig. 14-5. Impact strips protect the assembly through virtually the entire width.

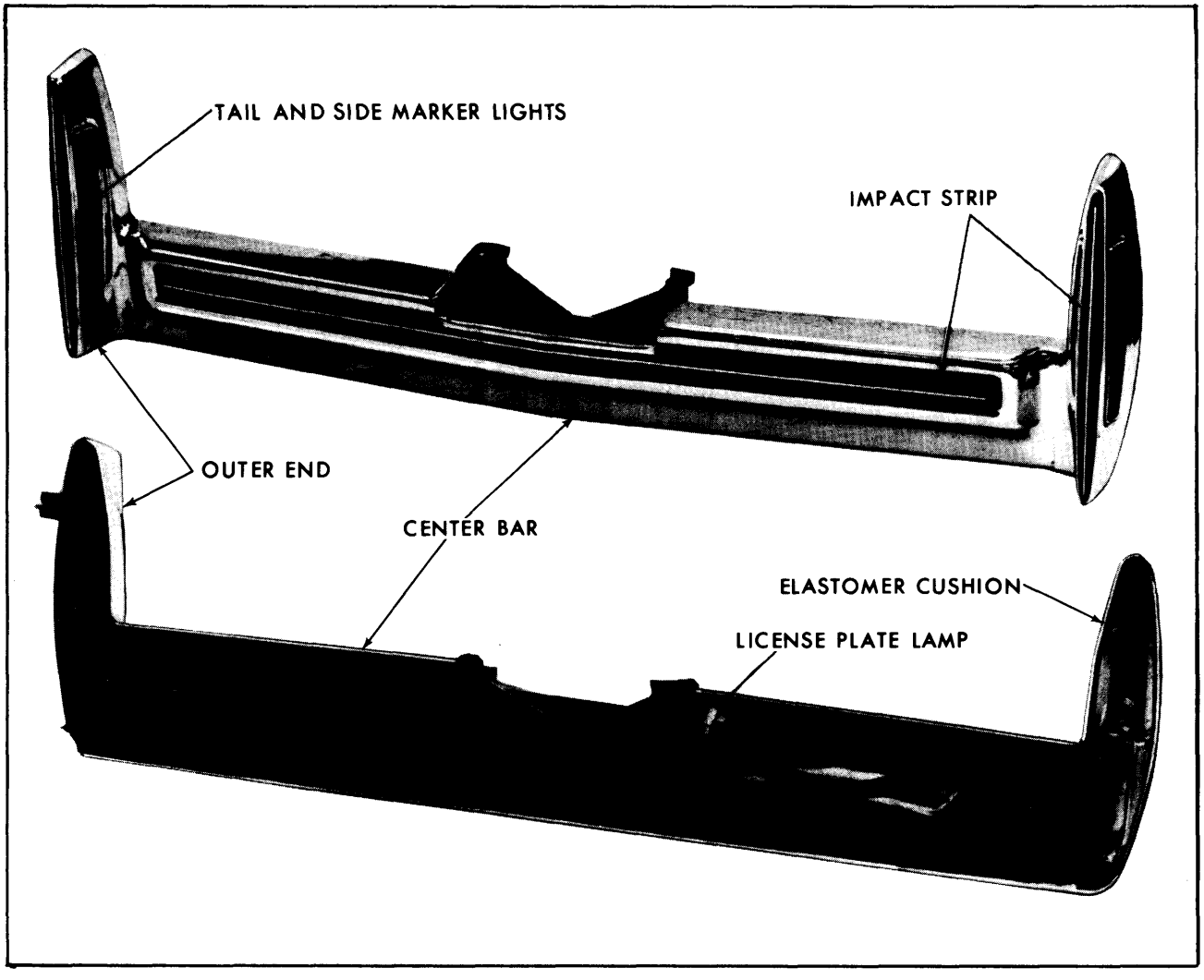


Fig. 14-5 Rear Bumper Assembly—Except Eldorado

BACK TO INDEX

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SERVICE INFORMATION

WARNING: HEED THE FOLLOWING WHEN HANDLING ENERGY ABSORBING DEVICES OR PERSONAL INDURY MAY RESULT.

1. DO NOT APPLY HEAT TO A UNIT.

2. DO NOT WELD IN THE AREA OF A UNIT.

3. DO NOT ATTEMPT TO REPAIR A DAMAGED UNIT. ALWAYS REPLACE WITH A NEW UNIT.

4. IF UNIT IS BOUND-UP AS A RESULT OF A COLLISION SUCH THAT IT CANNOT EXTEND, TAKE PRECAUTIONS TO AVOID SPRING-BACK WHEN BENDING SHEET METAL. SEE NOTE 2.

5. IF UNIT IS TO BE SCRAPPED RELIEVE THE GAS PRESSURE PRIOR TO DISPOSAL OF A UNIT. MAKE AN INDENTATION WITH A CENTER PUNCH IN THE SMALL CYLINDER SECTION OF THE ENERGY ABSORBER, FIG. 14-6.

USE A 1/8 INCH DRILL TO PENETRATE THE SMALL CYLINDER WALL.

BE SAFE! PROTECT YOUR EYES. WEAR APPROVED SAFETY GLASSES.

1. Testing Front or Rear Energy Absorber Operation

The right and left Energy Absorbing Devices are to be diagnosed separately. The following checks and separate judgments are to be made on each unit:

a. Leakage

Some oil wetting may be visible due to the grease packed in the crimp recess. Therefore, a stain or trace of oil on the piston tube near the crimp is normal. However, if oil is dripping continuously from the crimp or the stud end of the unit, a leak is indicated and the unit should be replaced.

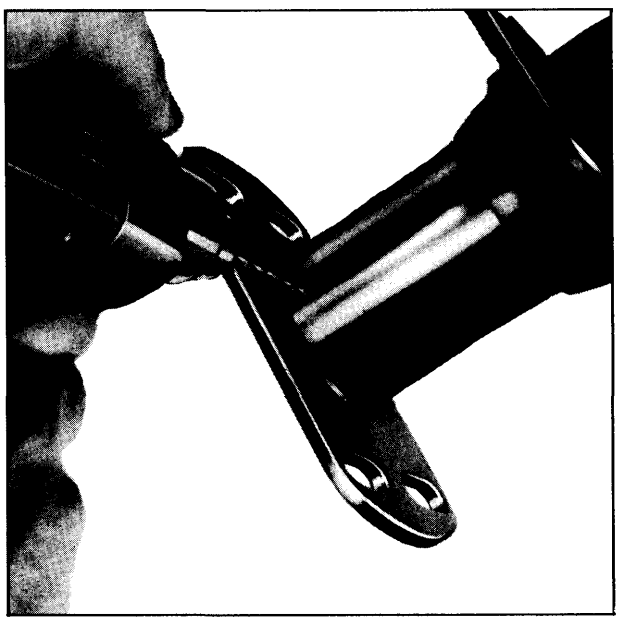


Fig. 14-6 Scrapping Energy Absorber

b. Damage

Observe the bumper bracket, piston tube, frame bracket and cylinder tube for evidence of visible distortion. Scuffing of the piston tube will occur when the unit is stroked and is to be considered normal.

If there is obvious damage to the unit, it should be replaced.

c. On Car

1. Position car in front of a suitable fixed barrier such as a pillar, wall, post, or other anchorable fixture.
2. Turn ignition to Off, place selector lever in Park, set parking brake, and apply service brake.
3. Position a hydraulic or mechanical jack between bumper and barrier such that jack is positioned squarely with bumper directly in line with Energy Absorber to be checked.
4. Apply pressure to compress Energy Absorber at least 3/8" using an indicator to detect exact amount of travel.
5. Release pressure and check indicator to determine whether Energy Absorber returned to its original position. If not, replace Energy Absorber.
6. Repeat Steps 3, 4, and 5 for second Energy Absorber.

WARNING: DRIVING INTO POSTS, WALLS, OR BARRIERS TO PERFORM THIS TEST IS NOT RECOMMENDED BECAUSE PERSONAL INJURY OR PROPERTY DAMAGE COULD RESULT.

d. On Bench

1. Position Energy Absorber lengthwise in arbor press.
2. Using a suitable measuring device, note original position of unit then use press to compress unit at least 3/8".
3. Release pressure and determine whether unit has returned to original position. If not, discard unit.

2. Inspection After Collision

If the collision was so severe that the bumper did not return to its original position, the energy absorber(s) will require replacing.

1. Stand clear of the bumper.
2. Provide a positive restraint, such as a chain or cable to hold the bumper in the position it is in.
3. Wear safety glasses and drill a small hole in the piston tube near the bumper bracket, Fig. 14-6, to relieve gas pressure.
4. Remove the energy absorber(s) after gas pressure has been relieved.

BACK TO INDEX

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3. Front Bumper

a. Removal

1. Support bumper at center with hydraulic jack. If car is equipped with Guide-Matic, remove two screws securing photosensor bellows to left side of upper grille and disconnect bellows.
2. Remove four bolts and two retainers securing bumper to EA unit.
3. Except Eldorado: remove nut securing lower end of support rods to tab on bumper outer ends.

Eldorado: Remove nut, two cushions, two retainers and spacer securing support rod to bracket on bumper end. Do not disturb nut just above upper cushion, as it controls cushion load and position.

4. Open hood and remove two retainers securing air deflector to lower center bar. On all cars except Eldorado, remove one bolt and tapping plate securing wheelhousing splash shield to each rear corner of bumper.
5. Repeat Steps 2 and 3 for other side of car and remove bumper.

b. Installation

1. Raise bumper into position. Make sure center air deflector and filler strips at headlight housings are resting on bumper. Make sure support rods are in tabs or bracket on bumper.
2. Insert two retainers in position behind mounting holes in bumper and install four bolts finger tight securing each EA unit to bumper.
3. Except Eldorado: install nut securing lower end of support rods to tab on bumper outer ends.

Eldorado: install retainer, cushion, spacer, second cushion and retainer, and nut securing each support rod to bumper bracket. Tighten nut to 18 foot-pounds.

4. Repeat Steps 2 and 3 for other side of car.
5. Open hood and install two retainers securing air deflector to lower center bar. Secure Guide-Matic bellows to grille with two screws. On all cars except the Eldorado, install one bolt and tapping plate securing wheelhousing splash shield to each rear corner of bumper.
6. Before tightening, check bumper to assure proper alignment. Vertical and side-to-side adjustments can be made using slotted holes in EA unit and bumper. Tighten bolts to 35 foot-pounds and remove jack.

4. Front Energy Absorbing Unit and Mounting Brackets (Fig. 14-4)

a. Removal

1. Support bumper at center with hydraulic jack.
2. Remove four bolts and washer assemblies and two retainer plates securing EA unit to bumper.
3. Remove four nuts, washers and bolts securing EA bracket and friction plate to frame.
4. Remove two bolts and washers and one tapping plate securing radiator cradle support bracket to EA bracket, if car is so equipped.
5. Rotate radiator cradle support bracket out of way and remove EA unit, mounting bracket, and friction plate as an assembly.
6. Remove three bolts and nuts securing EA unit mounting plate to EA bracket.
7. Remove one nut securing rear of EA unit to EA bracket. Slide EA unit forward and out of bracket.

b. Installation

1. Position EA unit inside mounting bracket and secure to front of bracket with three bolts and nuts, tightening to 55 foot-pounds.

(NOTE: Although there are four mounting holes in the EA unit, only three are used. Upper inboard hole is left blank.)

2. Install nut on EA unit mounting stud, tightening to 55 foot-pounds.
3. Position EA unit, friction plate, and bracket on rear of bumper center bar. Install four bolts and washers and two tapping plates and tighten bolts until snug. Do not torque at this time.
4. Line up holes in frame horn, friction plate, and EA mounting bracket. Install four bolts and nuts with washers so that bolt heads are inside frame horn. Tighten until snug, but do not torque.
5. Examine bumper for proper alignment and adjust as required. Fore and aft adjustment can be made by means of slotted holes in the EA mounting bracket. Vertical and crosscar adjustment is provided by slotted holes in the bumper center bar and the EA unit.
6. When proper alignment is achieved, tighten four bolts securing EA unit to bumper to 35 foot-pounds, and four bolts securing EA mounting bracket to frame to 75 foot-pounds; then remove hydraulic jack.
7. Rotate outboard cradle mount support bracket into position, if car is so equipped. Install two bolts and washers and one tapping plate securing cradle bracket to EA mounting bracket, tightening to 30 foot-pounds. Make sure cradle mount nut is torqued to 30 foot-pounds.

5. Front Bumper Guards and Bumper Guard Impact Strips—On Car (Fig. 14-7)

a. Removal

1. Remove two long screws and washers securing bumper bracket and bumper guard to bumper upper center bar.
2. Remove one bolt and washer assembly and one nut securing guard to bumper lower center bar.
3. Remove one bolt spacer and nut securing bumper guard to lower inner end of lower center bar and remove bumper guard.
4. Remove three nuts securing impact strip to bumper guard and remove impact strip.

b. Installation

1. Install impact strip on bumper guard, securing with three nuts. Tighten nuts to 15 inch-pounds. Do not overtorque or strip may become distorted.
2. Position bumper guard and bumper bracket on bumper. Install two long screws and washers, tightening to 30 foot-pounds.
3. Install one bolt and washer assembly and one nut securing guard to lower center bar, tightening bolt to 18 foot-pounds.

BACK TO INDEX

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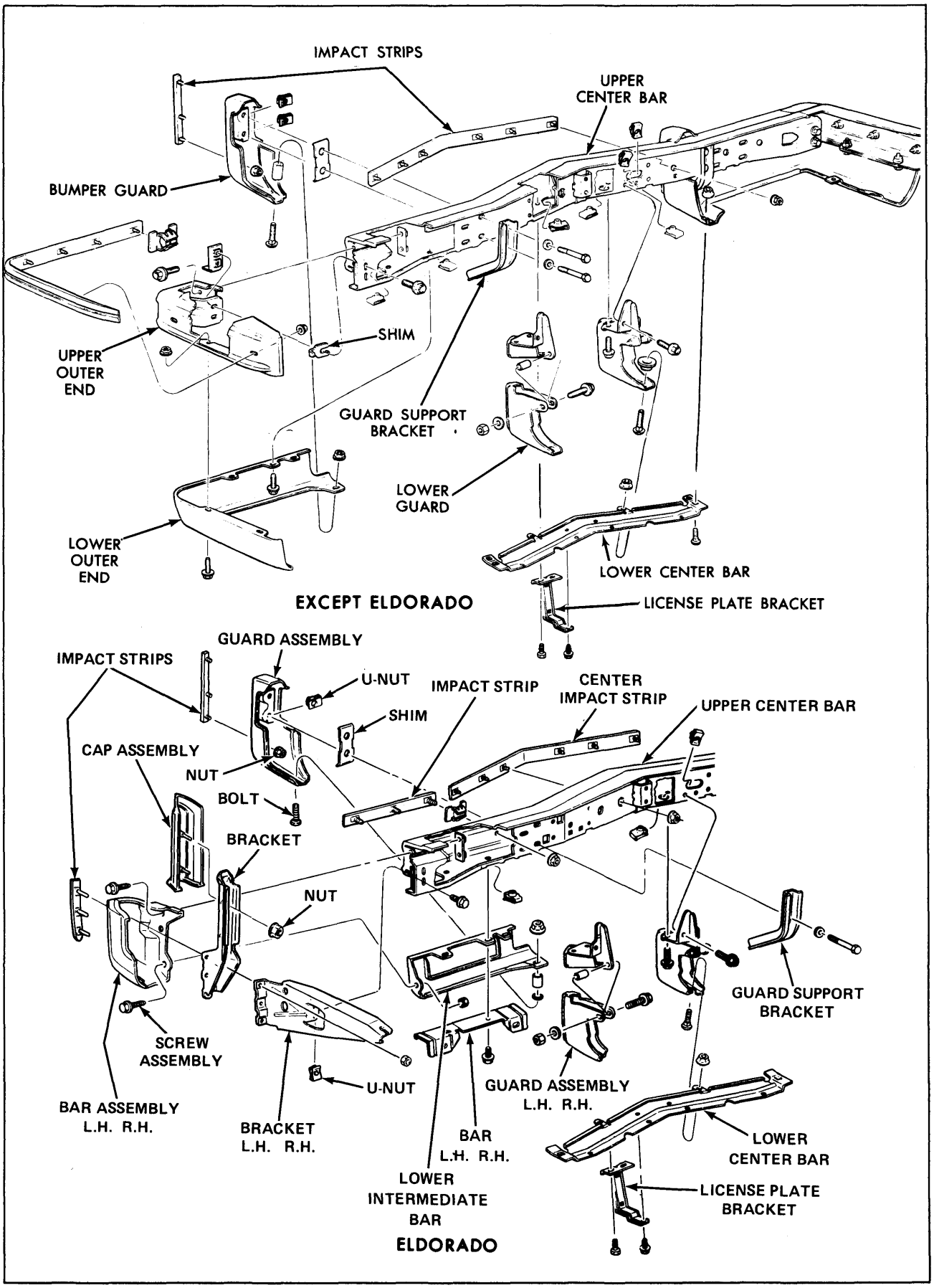


Fig. 14-7 Front Bumper Disassembled

BACK TO INDEX

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4. Make sure U-nut is in place and install one bolt, spacer and nut securing guard to lower inner end of lower center bar. Tighten to 18 foot-pounds.

6. Front License Plate Bracket (Fig. 14-7)

a. Removal

1. Remove two screws and washer assemblies securing each license bracket to upper and lower center bars and remove brackets.

b. Installation

1. Position brackets to upper and lower center bars and secure with two screw and washer assemblies.

7. Lower Guard (Fig. 14-7)

a. Removal

1. Remove one bolt and washer assembly, spacer and washer and nut securing lower guard to support bracket.
2. Remove one bolt, spacer and nut securing lower guard to lower center bar and remove guard.
3. Remove four bolts and washer assemblies securing lower guard support to upper center bar and remove support bracket.

b. Installation

1. Install bracket to upper center bar, and secure with four bolts and washer assemblies. Tighten to 35 ft. lbs.
2. Position lower guard and install one bolt, spacer and nut securing guard to lower center bar. Tighten to 20 ft. lbs.
3. Install one bolt and washer assembly, spacer and nut securing lower guard to support bracket. Tighten to 35 ft. lbs.

8. Lower Center Bar (Fig. 14-7)

a. Removal

1. Open hood and remove two retainers securing air deflector to lower center bar.
2. Remove one bolt and washer assembly securing each end of lower center bar to its respective bumper guard.
3. Remove two bolts and washer assemblies securing grille to lower mounting brackets and lower center bar.
4. Remove two screws and washer assemblies securing license plate brackets to upper center bar.
5. Remove two screws and washer assemblies securing license plate assembly to lower center bar and remove license plate assembly.
6. Remove two bolts, spacers and nuts securing lower leg of lower guard to lower center bar and remove lower center bar.

b. Installation

1. Position center bar and install two bolts, spacers and nuts securing lower leg of lower guard to lower center bar. Tighten to 20 ft. lbs.
2. Install two screws and washer assemblies securing license plate bracket to lower center bar. Tighten to 60 in. lbs.
3. Install two screws and washer assemblies securing license plate brackets to upper center bar. Tighten to 60 in. lbs.
4. Install two bolts and washer assemblies securing grille to lower mounting brackets and lower center bar. Tighten to 35 in. lbs.
5. Install one bolt and washer assembly securing each end of lower center bar to its respective guard. Tighten to 20 ft. lbs.
6. Install two retainers securing air deflector to lower center bar.

9. Front Bumper Center Impact Strip—On Car (Fig. 14-7)

a. Removal

1. Open hood and, using six access holes in rear of bumper center bar, remove six nuts securing impact strip to bumper and remove impact strip.

b. Installation

1. Position impact strip on bumper, engaging six studs in mounting holes. Check alignment of strip to bumper, as some side-to-side adjustment is possible.
2. Install six nuts on studs using access holes on rear face and underside of bumper. Tighten to 50 inch-pounds.

10. Front Bumper Outer Impact Strip—On Car (Fig. 14-7)

a. Removal

1. Of seven nuts securing impact strip, remove the four securing strip to bumper outer end. Access to nut at corner of bumper can be gained by using a U-joint socket and extension.

(NOTE: Eldorado impact strip is secured to outer end at three locations only.)

2. Remove two nuts securing strip to bumper center bar using access holes behind bumper bar.
3. Removal of center most attaching nut will have to be chisled off.

(NOTE: When replacing impact strip a repair retainer is available.)

b. Installation

1. Position impact strip on bumper, engaging each of seven studs (six on Eldorado) in mounting holes in bumper. Check alignment of strip to bumper.
2. Install two nuts securing impact strip to bumper center bar using access holes behind bumper. Tighten to 50 in. lbs.
3. Install nuts securing impact strip to bumper outer end. Access to nut at corner of bumper can be gained by using a U-joint socket and extension. Tighten to 50 in. lbs.
4. Install retainer at center most attaching.

BACK TO INDEX

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11. Front Lower Outer End—Except Eldorado (Fig. 14-7)

a. Removal

1. Remove one bolt and tapping plate securing wheelhousing splash shield to lower outer end of bumper.
2. Remove two bolts and nuts securing lower outer end to upper outer end.
3. Remove one nut securing support rod to lower outer bumper bar tab.
4. Remove one bolt, spacer, and nut securing lower outer end to rear of bumper guard.
5. Remove two bolts and washers securing lower outer end to bumper center bar.

b. Installation

1. Make sure U-nuts are in place on center bar, then position lower outer end against center bar and install two bolts and washers securing lower outer end to center bar.
2. Install one bolt, spacer, nut and washer assembly securing lower outer end to rear of bumper guard.
3. Install two bolts, nuts, and washers securing lower outer end to upper outer end.
4. Install support rod in lower outer bumper bar tab and secure with one nut and washer assembly.
5. Position wheelhousing splash shield on tab on bumper and fasten with one bolt and tapping plate.

12. Front Upper Outer End—Except Eldorado (Fig. 14-7)

a. Removal

1. Remove lower outer end as described in Note 11a.
2. Remove four nuts securing impact strip to upper outer end and remove strip from upper outer end.
3. Remove two screws and washer assemblies securing upper outer end and shims (and bumper support bracket on 6F and 6Z) to bumper center bar.

(NOTE: Take care to note number and position of shims for proper installation.)

4. Remove two screw and washer assemblies and tapping plate securing upper outer end to upper center bar.

b. Installation

1. Align outer end, center bar, (and support bracket, if so equipped) insert two bolt and washer assemblies from front side, and thread tapping plate a few turns.
2. Insert shims between outer end and center bar.
3. Continue tightening two nuts to 30 foot-pounds.
4. Install two screws and tapping plate securing bumper center bar to outer end, tightening to 30 foot-pounds.
5. Insert impact strip studs in outer end, securing with four nuts. Tighten to 50 inch-pounds.
6. Install lower outer end as described in Note 11b.

13. Rear Bumper—Except Commercial

a. Removal

1. Scribe alignment marks on bumper at EA unit for proper orientation on assembly.
2. Support bumper at center with hydraulic jack.
3. Remove four nuts and washers securing EA unit to bumper and remove jacking support bracket.
4. Repeat Step 3 on other side of car.
5. Open deck lid and pull trim out to gain access to outer end attaching nut.
6. Remove nut and seal assembly securing each outer end to body.
7. Move bumper away from body. Disconnect body connectors and remove screws securing ground wires to frame.
8. Remove bumper and remove shims from EA unit mounting bolts, and remove washer and shims from each outer end mounting bolt.

b. Installation

1. Place washers and shims on outer end mounting bolts and EA unit mounting bolts as required.
2. Move bumper into position. Install screws securing ground wires to frame and connect body connectors.
3. Locate outer end and EA unit mounting bolts in their proper position and position outer end and deck lid fillers.
4. Loosely install both outer end washers and nuts. Do not tighten.
5. Position jacking support bracket on EA unit mounting bracket and install 4 nuts and washers on each side of car. Do not tighten.
6. Position bumper according to scribed lines at EA units making sure jacking support bracket is touching support on body, and tighten mounting nuts to 30 foot-pounds.
7. Tighten outer end mounting nuts to 12 foot-pounds and reposition trunk trim.
8. Close deck lid and move jack away from car.

14. Rear Bumper Center Impact Strip—All Cars (Fig. 14-8)

a. Removal

1. Working under bumper, remove two screws securing license plate filler and retainers.
2. Remove ten nuts securing impact strip to bumper.
3. Remove license plate filler and retainers.

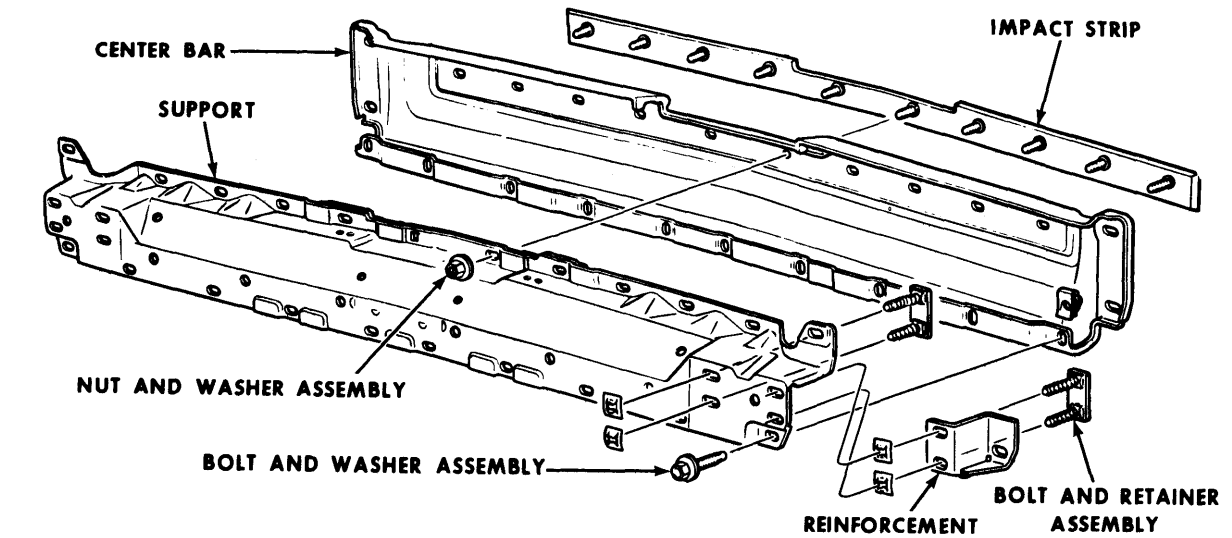
b. Installation

1. Position impact strip on bumper so that part number stamping is left of center of bumper.
2. Install two license lamp assemblies on center studs of impact strip.
3. Secure impact strip with ten nuts and washer assemblies on studs of impact strip. Tighten to 50 inch-pounds.

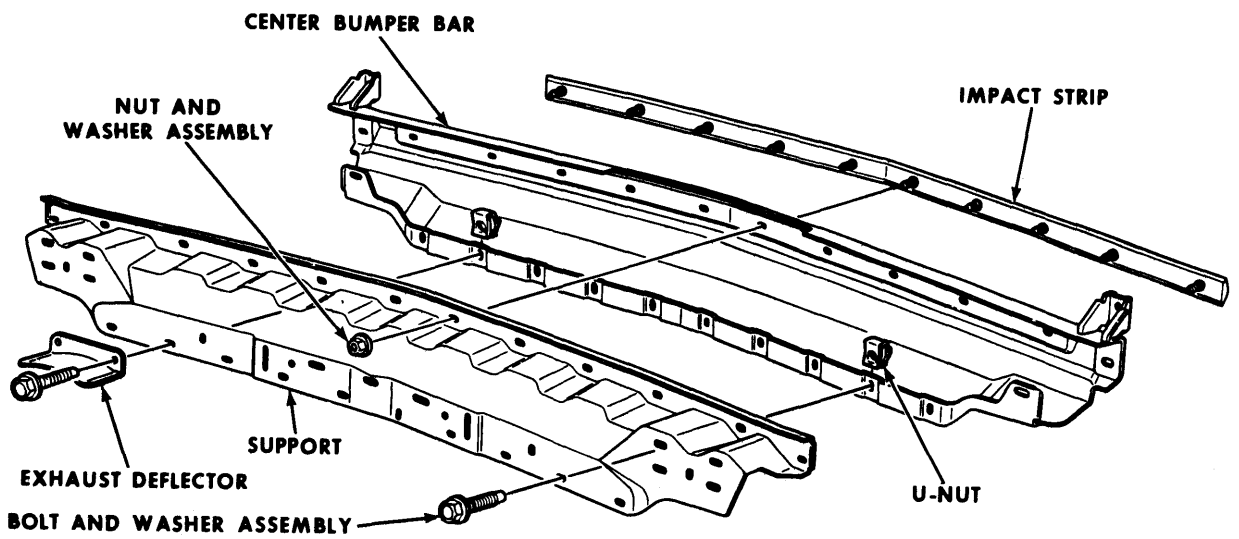
CAUTION: Do not overtorque or strip as it could take on a distorted appearance.

BACK TO INDEX

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EXCEPT ELDORADO AND COMMERCIAL



ELDORADO

Fig. 14-8 Rear Bumper Center Bar Assembly

BACK TO INDEX

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4. Install license plate filler and retainers and secure with two screws.

15. Rear Bumper Outer End, Eldorado and Commercial Chassis (Fig. 14-12) (Fig. 14-15)

a. Removal

1. Remove reflexes.
2. Working under car remove lower mounting screw and washer assembly and retainer.
3. Using Tool J-24394 or T45 torx, remove torx mounting screw from center reflex lamp opening.
4. Open deck lid and pull trim back to gain access to upper mounting nut and remove nut and seal assembly.

b. Installation

1. Install rear side marker bulbs and sockets and position outer end mounting stud into body.
2. Secure upper mounting stud with nut and seal assembly.
3. Install torx screw from center reflex lamp.
4. Install lower mounting screw and washer assembly and retainer.
5. Align outer end and tighten screws to 12 foot-pounds.
6. Install reflex.

16. Rear Bumper Elastomer Cushion—All Cars (Fig. 14-9)

a. Removal

1. Remove outer end as outlined in Note 15a.
2. Remove one screw and washer securing cushion to outer end and remove cushion.

b. Installation

1. Position cushion on outer end and secure with one screw and washer.
2. Install outer end as outlined in Note 15b.

17. Rear Quarter Filler Panel—Except Eldorado

a. Removal

1. Remove rear bumper as described in Note 13a.
2. Remove one screw at lower inboard retainer and remove retainer.
3. Remove remaining six screws and remove retainer and filler panel.

b. Painting (use specified material or equivalent)

All replacement filler panels are pre-painted in either color code 11 or 81. If car being worked on is any color other than 11 or 81, filler panel must be repainted according to the following procedure.

1. Clean part in solvent to remove any dirt, grease, or oil.
2. Sand damaged area with #400 sandpaper to feather edge the damaged area. If repainting a replacement part, sand entire part to promote adhesion.
3. Wash again in solvent to remove loose material.
4. Spray on one coat of ti-coat primer, Part No. 105 1214, or equivalent, and air dry five minutes.

(NOTE: Apply primer only if sanding has completely removed paint, exposing the black surface of the filler panel.)

5. Spray on three coats of special elastomeric lacquer and air dry 15 minutes.

(NOTE: Acrylic lacquer should not be used as its durability is not satisfactory.)

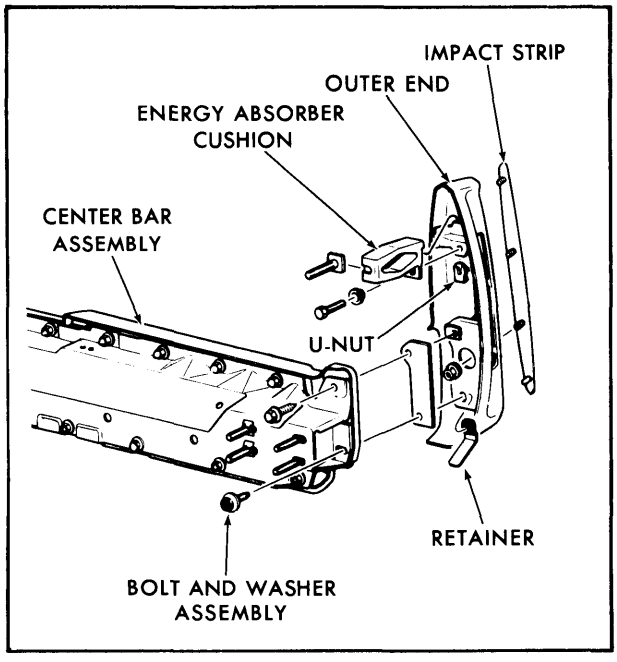


Fig. 14-9 Rear Bumper Outer End—Except Eldorado

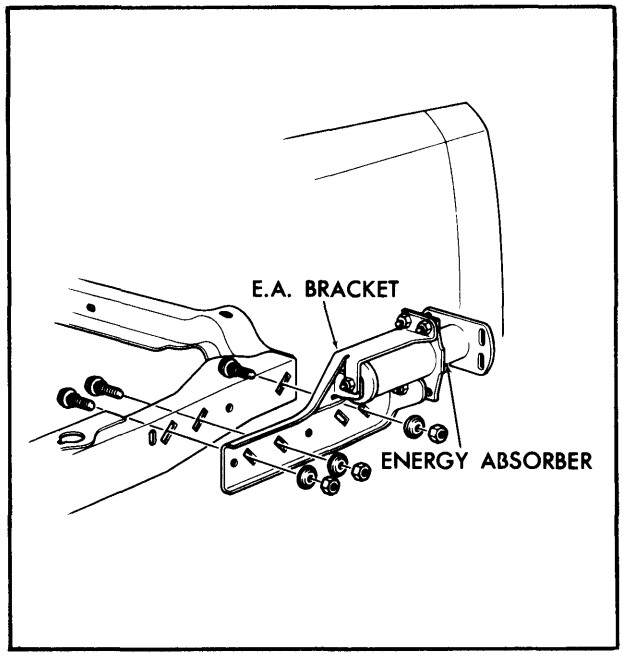


Fig. 14-10 Rear E.A. Unit and Mounting Bracket

BACK TO INDEX

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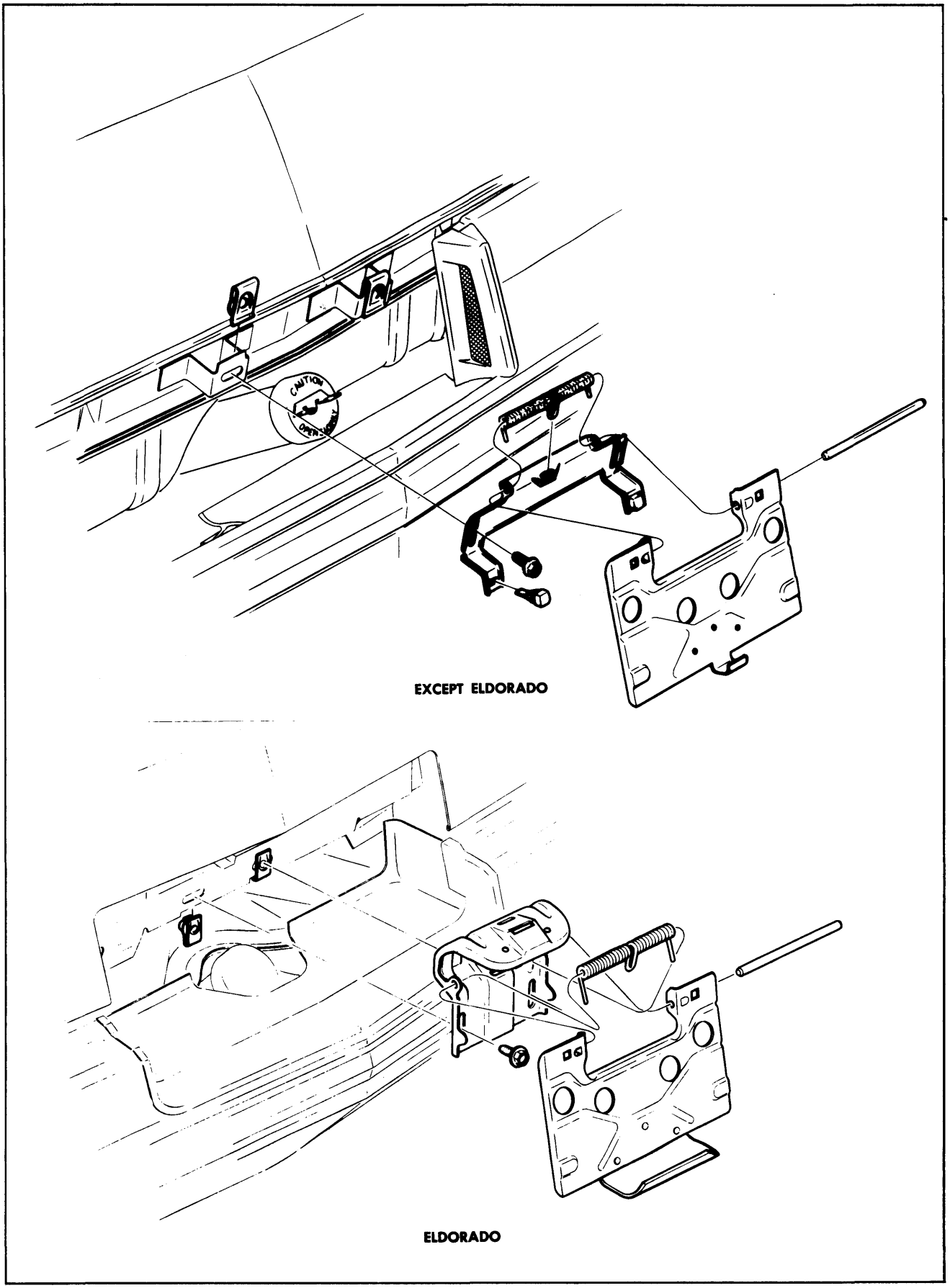


Fig. 14-11 Fuel Filler Door

BACK TO INDEX

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6. If, after drying, panel is not sufficiently glossy, spray on one coat of clear lacquer, Part No. 105 0754, or equivalent, and air dry for 30 minutes.

c. Installation

1. Position filler panel with retainer to rear quarter and secure with six screws.
2. Position lower inboard retainer and secure with one screw.
3. Install bumper as described in Note 13b.

18. Rear EA Unit and Mounting Bracket (Fig. 14-10)

a. Removal

1. Support bumper at center with hydraulic jack.
2. Scribe alignment mark on frame for proper orientation on assembly.
3. Remove four nuts and washers securing EA unit to bumper and remove jacking support bracket.
4. Remove three bolts, nuts, and washers securing mounting bracket to frame and remove EA unit with mounting bracket attached.
5. Remove three bolts and nuts securing EA unit mounting plate to bracket.
6. Remove one nut securing rear of EA unit to bracket. Slide EA unit forward and out of bracket.

b. Installation

1. Position EA unit in mounting bracket and secure to front of bracket with three bolts and nuts. Tighten to 55 foot-pounds.

(NOTE: Although there are four mounting holes in the EA unit, only three are used. The lower outboard hole is left blank.)

2. Install nut on EA mounting stud. Tighten to 55 foot-pounds.
3. Position mounting bracket on frame and secure with three bolts, nuts and washers. Do not tighten at this time.
4. Install jacking support bracket and four nuts securing EA unit to bumper. Do not tighten at this time.
5. Align mounting bracket with scribe lines and tighten three nuts, mounting bracket to frame, to 95 foot-pounds.
6. Tighten four nuts securing EA unit to bumper to 30 foot-pounds and remove hydraulic jack.

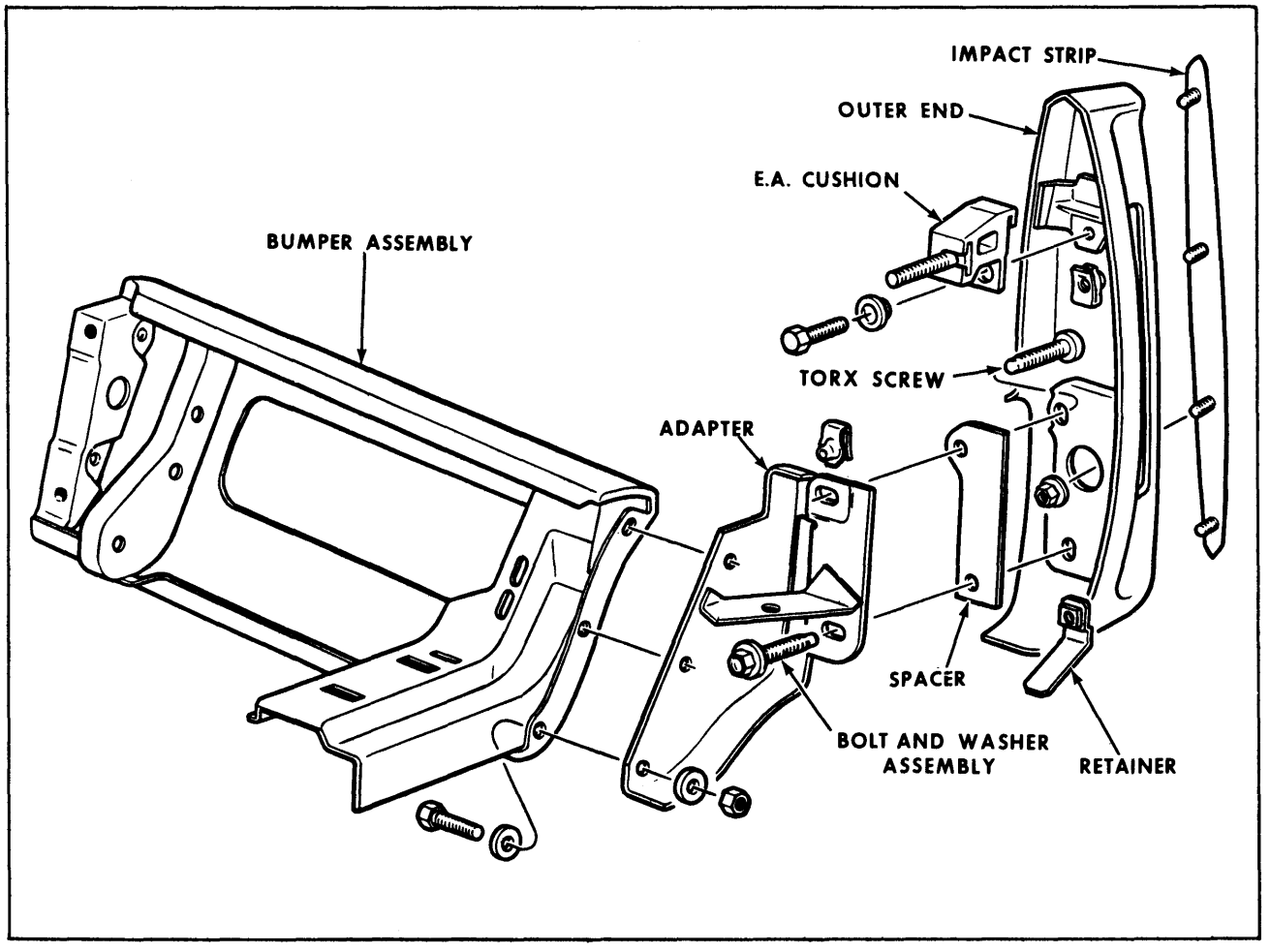


Fig. 14-12 Rear Bumper Disassembled—Commercial Chassis

BACK TO INDEX

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19. Fuel Filler Door (Fig. 14-11)

a. Removal

Open door and remove two screws securing backing plate to body and remove assembly.

(NOTE: If working on Eldorado, also remove clip securing lamp wiring to backing plate. Then, disconnect wiring at body harness.)

b. Installation

Make sure U-nuts are properly placed, then position door assembly and secure with two screws. If car is an Eldorado, connect wiring at body harness and clip wire to backing plate.

ELDORADO BUMPERS

GENERAL DESCRIPTION

Eldorado front bumpers are of ten piece construction, Fig. 14-13. Attached to the upper center bar are two bumper guards, a lower center bar, a lower intermediate bar on each side, and one-piece outer ends. Attachment to frame, energy absorption provisions, grille mounting, and other features are similar to their counterparts on other styles. Refer to the forward portion of this section for further information.

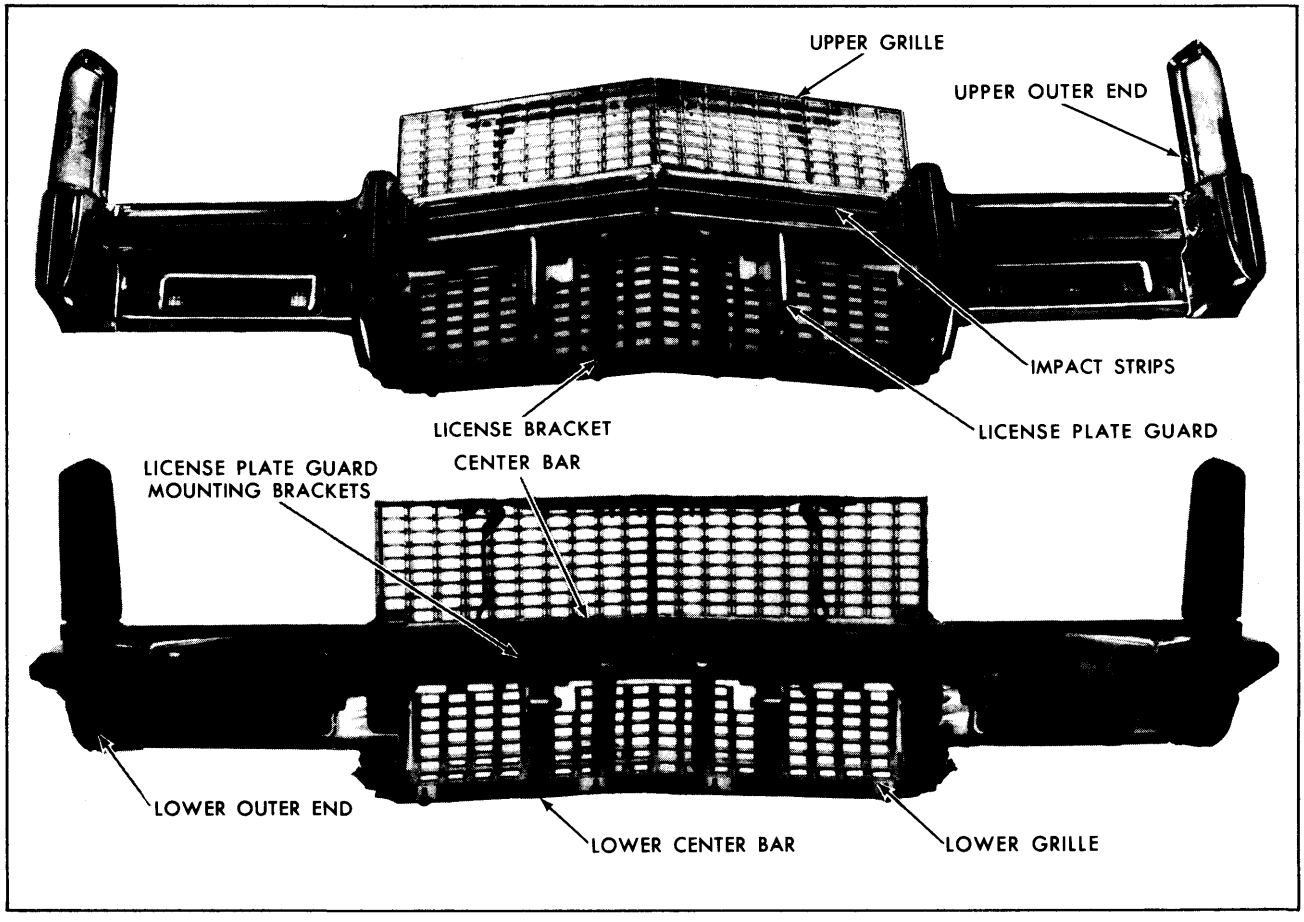


Fig. 14-13 Eldorado Front Bumper

SERVICE INFORMATION

The service information that follows pertains only to those features exclusive to the Eldorado. Service Information given in the forward portion of this section also pertains to the Eldorado, except for those note headings in which "Except 6L" or "Except Eldorado" is explicity stated.

BACK TO INDEX

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20. Front Fender Filler Panel—Eldorado

a. Removal

1. Working under car, remove three screws and washers securing filler and reinforcement strip to forward end of fender.
2. Remove one screw and washer securing reinforcement strip to filler panel.

b. Painting

Follow procedure in Note 17b.

c. Installation

1. Position reinforcement strip on filler panel and insert four screws and washers.
2. Position assembly on front fender and tighten mounting screws to 25 inch-pounds.

21. Front Bumper Outer End—Eldorado (Fig. 14-7)

a. Removal

1. Remove bumper following procedure in Note 3a.
2. Remove two bolt and washer assemblies and tapping plate securing outer end to center bar.
3. Remove one bolt and nut securing outer end to lower intermediate bar and remove outer end.
4. Remove three nuts from studs on pad, remove bumper support bracket and cap bracket with cap.

b. Installation

1. Position outer end and secure to lower intermediate bar with one bolt and nut.
2. Install two bolt and washer assemblies and tapping plates securing outer end to center bar. Tighten to 30 foot-pounds.
3. Install three nuts to studs on pad, install bumper support bracket and cap bracket with cap. Tighten to 20-30 foot-pounds.
4. Install bumper as in Note 3b.

(NOTE: Pad assembly can be removed on car from bumper for replacement.)

22. Rear Bumper Vertical Impact Strip

a. Removal

1. Remove rear reflex.
2. Remove screw securing impact strip to outer end.
3. Working from behind bumper, remove nut securing impact strip to outer end and remove strip.

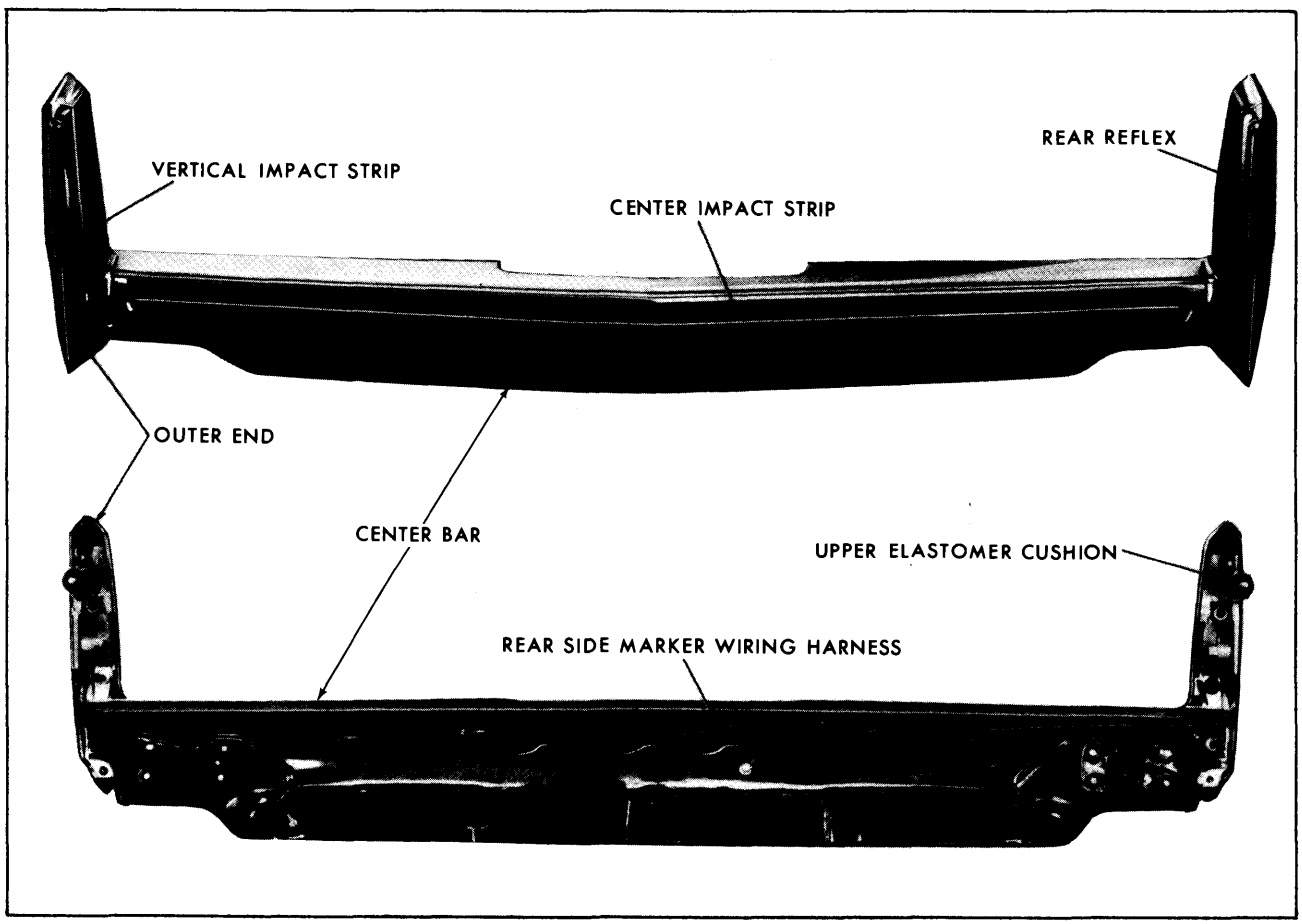


Fig. 14-14 Eldorado Rear Bumper

BACK TO INDEX

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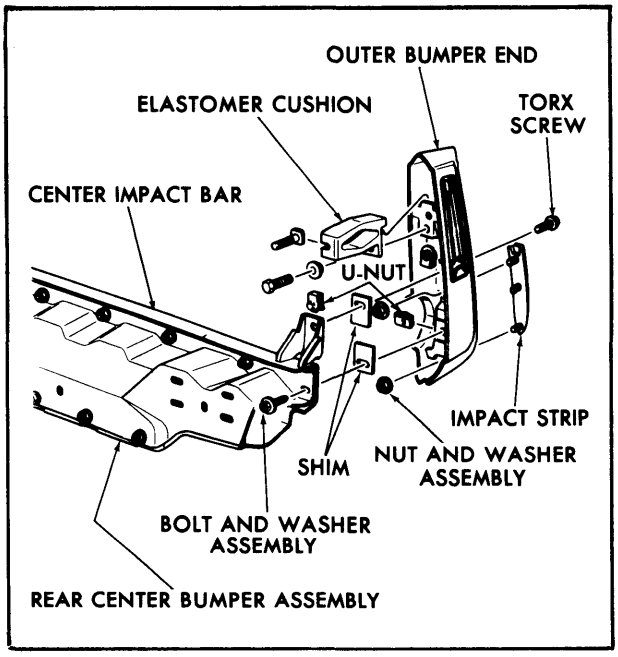


Fig. 14-15 Eldorado Rear Bumper Outer End

b. Installation

1. Postion impact strip on outer end and secure with screw in reflex opening.
2. Working from behind bumper, install one nut securing impact strip to outer end.
3. Install reflex.

23. Rear Quarter Filler Panel—Eldorado

a. Removal

1. Open trunk and pull trim away from outer end area.
2. Working from inside trunk, remove four nuts securing filler panel to body.
3. Pull filler panel away from outboard side of outer end and remove two screws securing filler panel to body.
4. Remove outer most screw on trunk lid filler and pull outer end filler panel up and away from body.

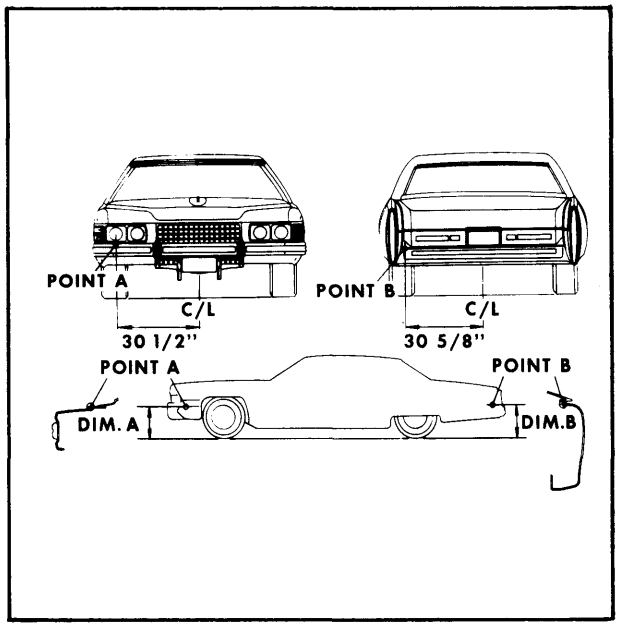


Fig. 14-16 Bumper Height Locating Points—C-Car

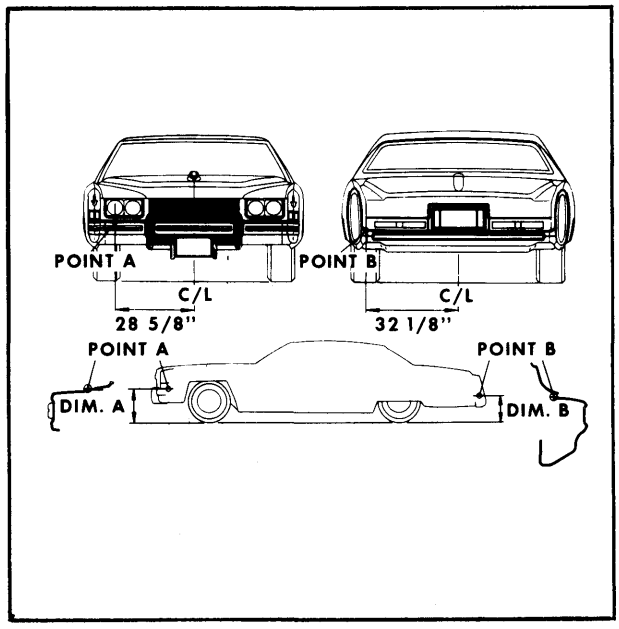


Fig. 14-17 Bumper Height Locating Points—Eldorado

b. Installation

1. Position filler panel around outer end and under trunk lid filler panel.
2. Install outer most screw on trunk lid filler panel.
3. Pull filler panel away from outboard side of outer end and install two screws securing panel to body.
4. Working from inside trunk, install four nuts securing filler panel to body.
5. Reposition trunk trim and close trunk lid.

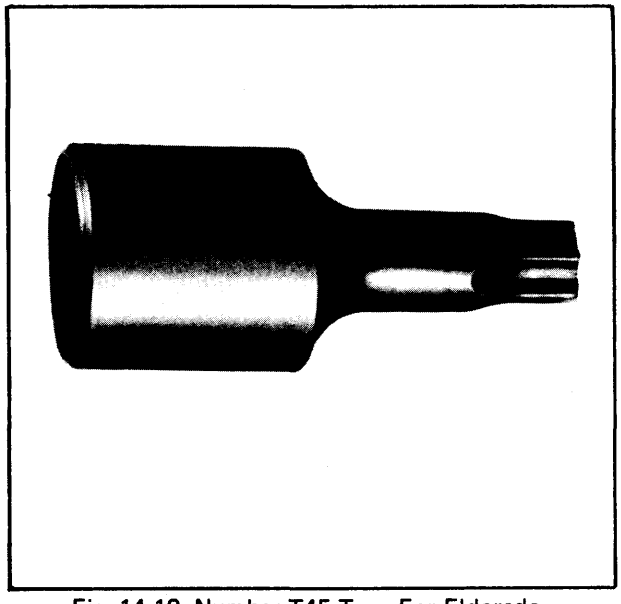


Fig. 14-18 Number T45 Torx For Eldorado And Commercial Chassis

BACK TO INDEX

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24. Bumper Height Specifications (Fig. 14-16 and 14-17)

The maximum and minimum specifications for bumper-to-ground heights are shown in the following chart:

Bumpers	Maximum	Minimum
Dim. A		
Front—All Cars	24 1/4"	20 3/16"
Dim. B		
Rear—C-Cars	24 3/8"	21 1/16"
Eldorados	22 15/16"	19 15/16"

Before measuring heights, the folowing items should be checked:

- Full fuel tank
- No passenger or cargo load
- Proper construction type and size tires, inflated to proper air pressure (see following chart).

Tire Pressure Chart

	Front	Rear
C-Car	22 PSI	22 PSI
Seventy-Five	26 PSI	26 PSI
Eldorado	25 PSI	20 PSI

(NOTE: These pressures are used for measurement only. Inflate tires to pressure shown on tire placard inside glove compartment after measurements.)

Tire pressure tolerance is ±2 PSI and tires are to be checked at room temperature.

- All options and equipment properly installed (including floor mats and trunk mat in appropriate position)
- Spare tire and tools must be properly stowed
- Floor or ground must approximate level surface
- Front seat should be in most rearward position
- If car has Automatic Level Control, system must be operational with shock absorbers inflated as required by leveling valve with a maximum of 8 PSI retained by the check valve
- Hood and all doors should be closed
- Bounce front of vehicle down at center of front bumper and then at rear bumper to centralize spring and standing height, front and rear. Important: front bumper must be Bounced first.

25. Bumper Adjustments

If adjustments of the bumper height become necessary after alterations or service, adjustments can be accomplished by:

- Limited adjustment of bumper up or down
- Adjustment of torsion bars on Eldorado
- Trimming of ALC rear control valve, if so equipped
- Replacement of coil springs

TORQUE SPECIFICATIONS

Material No.	Application	Thread Size	Torque
284M	Impact Strip Nuts (Except Bumper Guards)	1/4-20	50 in. lbs.
284M	Bumper Guard Impact Strip Nuts	#10-24	5 in. lbs.
275M/1050-65	Lower Center Support Rod Screws	5/16-18	18 ft. lbs.
280M	Bumper Guard to Center Bar Screws	3/8-16	30 ft. lbs.
275M/1050-65	Lower Outer End Screws	5/16-18	18 ft. lbs.
275M/1050-65	Upper Outer End to Center Bar Bolts	3/8-16	30 ft. lbs.
1010-20	License Plate Bracket to Upper and Lower Center Bars	1/4-20	50 in. lbs.
6010M	License Plate Molding to Bracket Screws	#10-16	30 in. lbs.
275M	EA Unit to Bumper Center Bar Bolts	7/16-14	35 ft. lbs.
286M	EA Unit to Mounting Bracket Nuts	7/16-14	55 ft. lbs.
286M	EA Mounting Bracket to Frame Nuts	1/2-13	75 ft. lbs.
6010M	Rear License Lamp and Housing Screws	#10-24	30 in. lbs.
1050	Back Up Lamp Mounting Nuts	3/16	35 in. lbs.
286M	Rear Lower Elastomer Cushion Nut	1/2-13	See Note 16.
286M	Rear Lower Mounting Plate to Frame	1/2-13	50 ft. lbs.
286M	Rear Outer End to Center Bar Nuts	3/8-16	30 ft. lbs.
301M	Rear Lower Mounting Bracket to Frame Nuts	1/2-13	75 ft. lbs.
286M	Rear Bumper to Quarter Panel Nut	3/8-16	See Note 13.
280M	Rear Outer End to Center Bar Bolts - Eldorado	3/8-16	30 ft. lbs.
6010M	Rear Outer End Filler Panel to Extension Housing	#10-24	25 in. lbs.
6010M	Rear Outer End Filler Panel to Rear Quarter	#8-18	25 in. lbs.
	Rear Bumper Center Impact Strips	3/8-16	50 in. lbs.

BACK TO INDEX

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TABLE OF CONTENTS

Subject	Page
Cruise Control	15-2
Guide-Matic	15-12
Twilight Sentinel	15-18
Rear Window De-Fogger	15-25
Controlled Cycle Windshield Wiper System	15-28
Theft Deterrent System	15-29
Fuel Monitor System	15-35
Sunroof	15-37
Astroroof	15-48
Automatic Door Locks	15-49
Radio	(See Section 12)
Lamp Monitor System	(See Section 12)

BACK TO INDEX

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WARNING: IF EQUIPPED WITH AIR CUSHION RESTRAINT SYSTEM, DO NOT ATTEMPT ANY ADJUSTMENT, REPAIR OR REMOVAL OF ANY PORTION OF THE ELECTRICAL SYSTEM WHICH WOULD REQUIRE REMOVAL OR DISCONNECTING OF ANY COMPONENT OF THE AIR CUSHION RESTRAINT SYSTEM UNTIL THE DISCONNECTION PROCEDURE IS COMPLETED. THIS PROCEDURE MUST BE FOLLOWED TO PREVENT ACCIDENTAL DEPLOYMENT OF THE SYSTEM WHICH COULD RESULT IN PERSONAL INJURY AND/OR DAMAGE TO THE SYSTEM'S COMPONENTS.

A.C.R.S. DISCONNECTION PROCEDURE

Turn ignition switch to "LOCK" position. Disconnect the negative battery cable from the battery and tape end.

CRUISE CONTROL

THEORY OF OPERATION

Cruise Control is a speed control system that uses manifold vacuum to actuate the throttle servo unit. The servo moves the throttle when speed adjustment is necessary by receiving a varying amount of controlled vacuum from the transducer unit.

The speedometer cable from the transmission drives the transducer, and a cable from the transducer drives the speedometer. The operation of the transducer unit is controlled by an on-off switch on the instrument panel and an engagement switch located at the end of the turn signal lever, Fig. 15-1.

Two systems for brake release are provided:

An electric switch mounted on the brake pedal support disengages the solenoid in the transducer, venting system vacuum to atmosphere through the transducer filter. A vacuum dump valve is also mounted on the brake pedal bracket and vents system vacuum to atmosphere as a second disengagement system.

Engagement Switch (Fig. 15-1)

The engagement switch, located within the turn signal lever, has three positions. In the fully released position, the switch passes current through resistance wire to effect a "hold in" magnetic field in the transducer solenoid. This current is sufficient only to hold the solenoid in place once it has been actuated by the "pull in" circuit. Depressing the button partially allows current to flow to the transducer solenoid at full voltage by-passing the resistance, which causes the solenoid to pull in. Depressing the button fully opens the circuit to both the resistance and standard solenoid feed wires and the solenoid becomes de-activated.

During vehicle operation the three switch positions have the following functions:

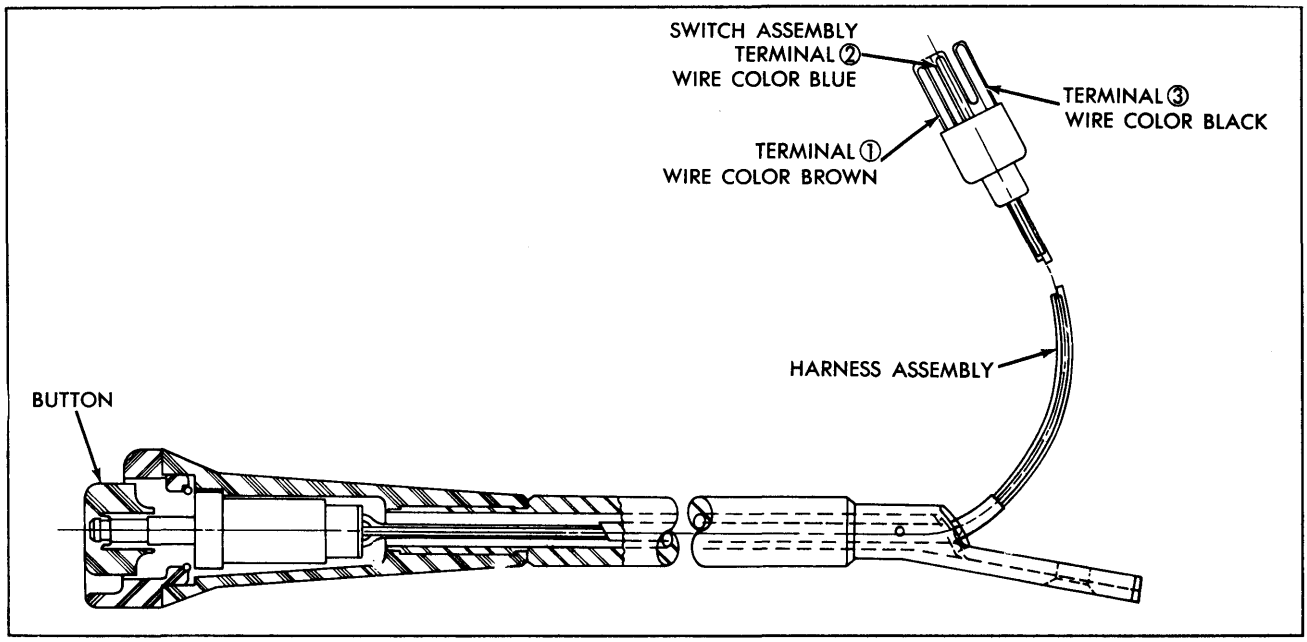


Fig. 15-1 Engagement Switch

BACK TO INDEX

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a. Switch in Free Position (On-Off Switch "ON")

1. System not engaged: No function of the system will occur although a small current is flowing through the solenoid via the resistance wire.

2. System engaged: The small current flowing through the resistance wire is holding the solenoid in the engaged position.

b. Switch Partially Depressed (On-Off Switch "ON")

Full voltage is applied to the solenoid by-passing the resistor which sets the transducer to maintain the vehicle speed at the time of transducer engagement.

c. Fully Depressed (On-Off Switch "ON")

No current flows to the solenoid and the transducer is inactive. This position is used by the driver when he desires to raise or lower his controlled speed. He may accelerate to his new speed, press the button fully (transducer releases previously set speed) and release the button. Upon releasing the button, current passes through the partially depressed position and the solenoid is "pulled in", then into released position which provides "hold in" current. The driver may also press the button fully with no pressure on the accelerator pedal. In this case the transducer releases control of the throttle which returns to idle and the car slows. When the button is released the solenoid is pulled in and held in respectively and the transducer resumes speed control at the speed of the vehicle during the moment of button release (at vehicle speeds over 24 mph).

On-Off Switch

This switch is located on the instrument panel left of the steering column. The toggle switch completely controls the electrical power to the Cruise Control system. When the switch is in the "OFF" position, the system cannot be engaged. When the switch is in the "ON" position, the "ON" light is lit and the system may then be engaged with the switch located within the turn signal lever, at any speed above approximately 24 mph.

Brake Release Switches

One electrical brake release switch and one vacuum release valve are employed in the Cruise Control system. When the brake pedal is depressed, the electric release switch cuts off the voltage supplied to the engagement switch, cutting off power to the transducer unit. The transducer is then disengaged and requires engagement switch operation to return it to operation. A vacuum release valve operates after the electric release switch whenever the brake pedal is depressed. This switch opens a port to atmospheric pressure that dumps the vacuum in the servo unit thereby returning the throttle to the idle position.

Servo Unit

The servo unit is a vacuum actuated, variable position diaphragm assembly that operates the position of the throttle plates when the system is in operation. It is powered by controlled vacuum from the transducer and operates the throttle linkage via a bead chain. The servo has a port on the sealed side of the diaphragm housing. When controlled vacuum is applied to this port, atmospheric pressure moves the diaphragm which pulls on the bead chain thus opening the throttle plates.

Transducer

The transducer is located on the cowl near the centerline of the car. The device has two primary functions which are controlled by the pull-in of the solenoid. First, it is a vacuum switch which, when engaged by the driver, supplies vacuum to a "Tee" fitting. Second, it allows the metering valve clutch spring to grasp the rubber clutch which is fixed to the speed cup spindle assembly. A variation in vehicle speed results in a slight rotation of the rubber clutch which in turn moves the air valve which meters a small variable quantity of air to the system where it blends with vacuum, thus providing the servo unit with controlled vacuum that will maintain the

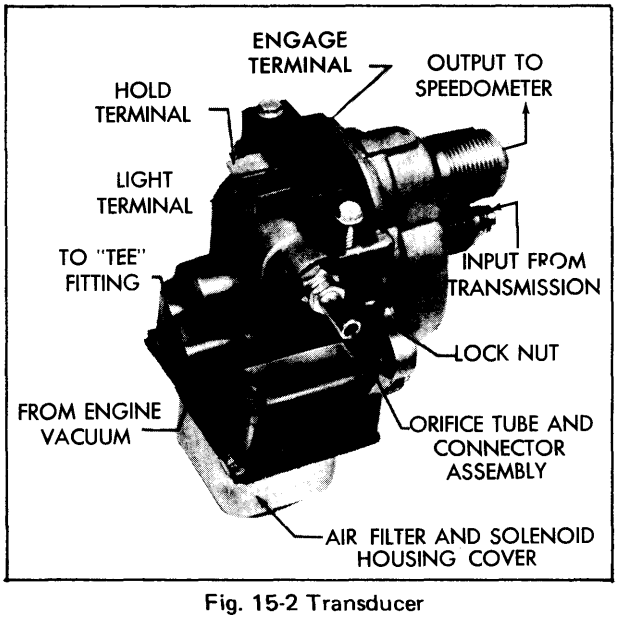


Fig. 15-2 Transducer

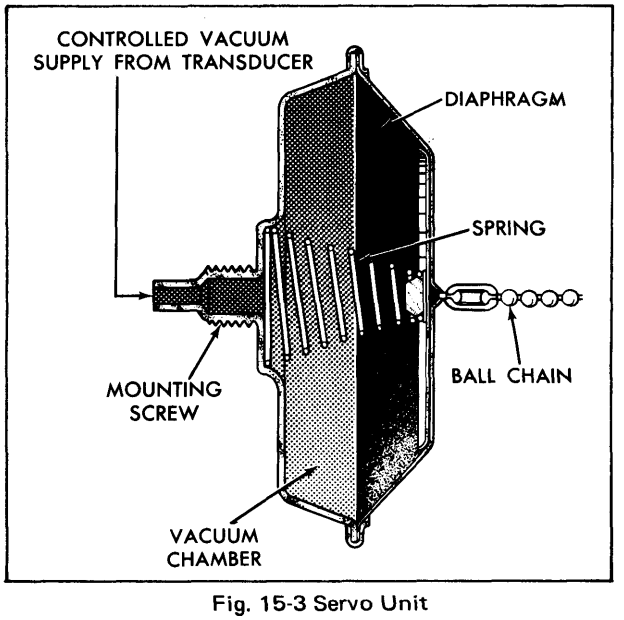


Fig. 15-3 Servo Unit

BACK TO INDEX
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selected speed. In operation, at cruise speed, a proper balance of air and vacuum is blended into the system and is imposed upon the servo unit to maintain an "on speed" cruise condition. See Figs. 15-2 and 15-3.

An additional function of the transducer is to drive the speedometer. The speedometer cable from the transmission which drives the transducer speed sensing assembly also is directly geared (at a one-to-one ratio) to a second cable connected to the instrument panel speedometer.

The transducer is electrically engaged and disengaged through operation of the engagement switch, on-off switch, and the electric brake release switch. Two subassemblies make up the unit: one being the magnetic speed sensing assembly and the other the solenoid actuated vacuum switch, air bleed and filter, and low limit speed switch assembly. See Fig. 15-2.

a. Magnetic Speed Sensing Assembly

The speed sensing assembly operates in the same manner as a speedometer unit except that instead of rotating a needle through an angle proportional to vehicle speed, it rotates a rubber drum which is clutched to the air bleed valve when the system is in operation.

The assembly is driven by the speedometer cable from the transmission which rotates a disc shaped ferrite magnet. Facing the magnet is the driven disc which is mounted to the same shaft as the rubber drum. A spiral hairspring is connected to the driven shaft and is calibrated to allow an angular rotation of the rubber drum which is proportional to car speed. If the car doubled its speed, the shaft would rotate to twice its previous angle as may be seen by noting the operation of a speedometer. The driven disc is sandwiched between the magnet and a field plate. The field plate forms a returning path for the magnetic field from the magnetic disc.

b. Vacuum Switch, Air Bleed and Filter, and Low Limit Speed Switch

The speed sensing assembly has a rubber drum which extends into the air bleed metering assembly. This rubber drum has a tang extending from its surface. When the car reaches about 24 mph, the tang has rotated enough (moved by the driven disc in the magnetic field) to allow a spring loaded electrical contact to close. This contact is in series with the solenoid coil so that below approximately 24 mph, no transducer operation is possible.

Surrounding the rubber drum is a "U" shaped spring clip which is held spread away from the drum by the nose of the solenoid when the solenoid is in the relaxed position. The rubber drum and "U" clip comprise the speed clutch of the transducer. When energized, the solenoid nose moves toward the drum and releases the clip ends which are then free to spring inward and clamp itself by friction to the drum. Now, any change in car speed will rotate the drum and move the "U" clip just as a speedometer moves its needle. The top of the "U" clip is attached to the air bleed valve, which slides on the orifice tube and covers or uncovers air ports in the wall

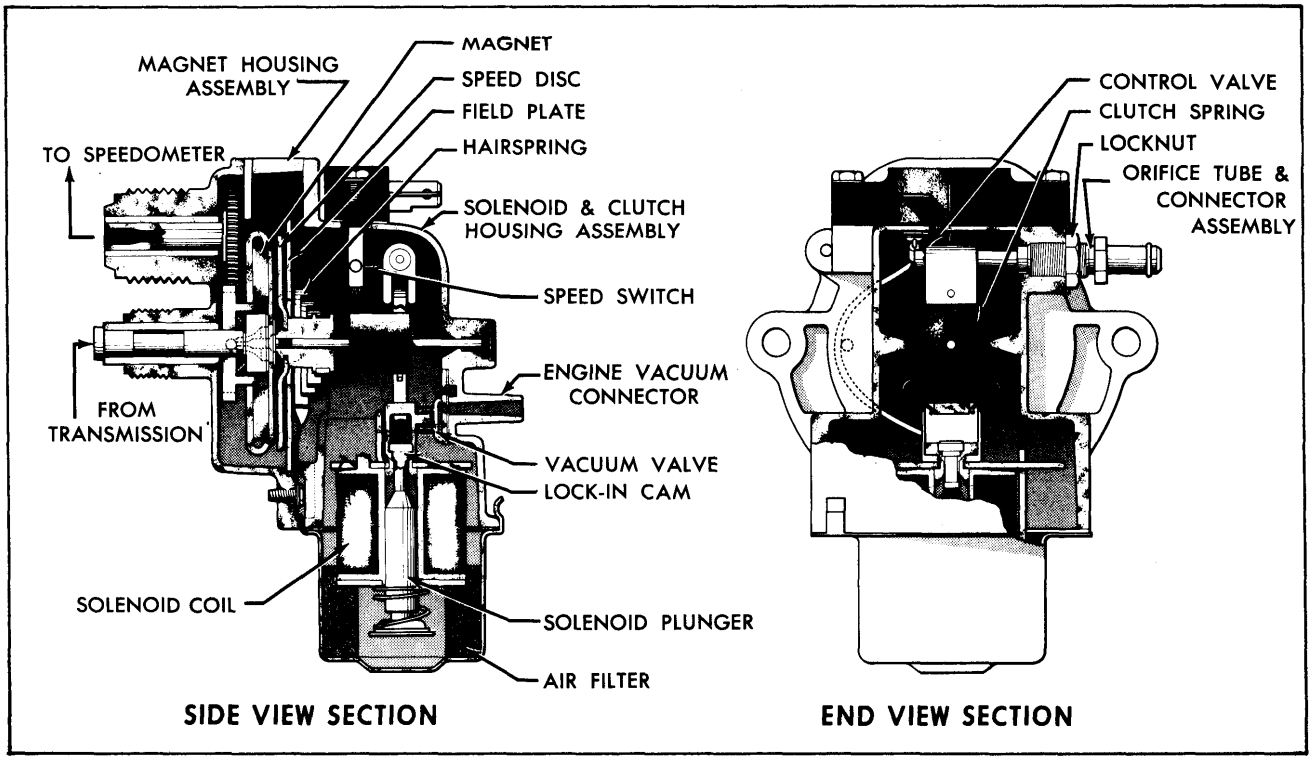


Fig. 15-4 Transducer Cross Section

BACK TO INDEX

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of the tube (the tube inner end is plugged) whenever car speed changes from the speed at which the solenoid was energized. The direction of drum rotation is such that resulting bleed valve operation will cause the servo to decrease engine power if the car exceeds the preset speed and increase engine power if car speed decreases. The air which passes out the orifice tube enters the transducer through the openings in the solenoid housing, passes through the oil wetted polyurethane filter, and then enters the orifice tube ports.

When the solenoid is de-energized, the nose retracts and forces the ends of the "U" clip outward so that the rubber drum is released.

Simultaneously with the clutching and declutching of the "U" clip, the solenoid operates a vacuum valve which slides over two ports in the transducer wall. When the solenoid is de-energized, the slide valve seals the manifold vacuum port and opens the system port to atmospheric pressure inside of the transducer case. When the solenoid is energized, the valve overlaps the two ports and connects manifold vacuum to the control system.

During system operation the following events occur:

1. Car speed below 24 mph--the solenoid pull-in circuit cannot function because the rubber drum has not rotated far enough to close the low speed solenoid contact. The solenoid is receiving a small current via the 40 ohm resistance wire unless the brake pedal is depressed, engagement switch is fully depressed, ignition switch is Off, or On-Off switch is Off.

2. Car speed above 24 mph--the tang on the rubber drum has rotated enough to allow the low speed solenoid contacts to close. The pull-in circuit is now ready for engagement.

3. Driver partially depresses engagement switch--full current flows through the solenoid to pull it into operation, releasing the "U" clip which permits the clip spring tension to grip the rubber drum. Also the solenoid plunger completes the ground for the Cruise light on the driver's control. Simultaneously, the vacuum switch applies manifold vacuum to the system which is blended with air being introduced from the transducer. The balance of air and vacuum is impressed upon the servo to provide initial throttle positioning.

4. Driver releases the engagement switch--current flows to the solenoid through the 40 ohm wire and since the solenoid is "pulled in", the reduced current flow is sufficient to hold it in position and the cruise light remains On.

5. The car begins to ascend a hill--car speed decreases very slightly and the magnetic force on the driven disc of the speed sensor is decreased thereby reducing the angle of rotation of the rubber drum slightly. Since the "U" clip is gripping the drum, it moves the air bleed valve in that direction which covers more of the air bleed ports. With less air bleeding into the system, a higher vacuum level is achieved at the servo diaphragm, opening the throttle angle to correct for the underspeed condition.

6. The car begins to descend a hill--car speed increases slightly and the air bleed valve moves in that direction which uncovers the air bleed ports. With more air bleeding into the system, a lower vacuum level is achieved at the servo diaphragm decreasing the throttle angle to correct for the overspeed condition.

7. Driver accelerates by pressing accelerator pedal--car speed increases and the system responds by moving the diaphragm to decrease throttle opening. Since a bead chain is used, the chain merely relaxes and has no effect on throttle operation. After the driver releases pressure from the pedal, the throttle will close until car speed decreases to the preset speed. At that point the transducer bleeds less air to the "Tee" fitting which opens the throttle enough to maintain the preset speed and system returns to a stable condition.

8. Driver desires higher controlled speed, presses accelerator until new speed is reached, and depresses engagement switch fully and releases button--speed sensing assembly tries to turn in a direction that would decrease the throttle opening until the driver fully depresses the engagement switch. Then the current is cut off to the solenoid which retracts; the solenoid cam expands the "U" clip releasing its grip on the rubber drum and removes the ground from the cruise light. The drum and disc assembly then rotates to a new position because of the higher car speed. When the solenoid retracts, it also shuts off vacuum to the system and opens the vacuum port to atmospheric pressure within the transducer thereby bleeding down the servo toward the relaxed position. As the driver releases the engagement switch, "pull-in" and "hold-in" of the solenoid occur. The system is now engaged to maintain the car speed at the time of engagement switch release and the cruise light is on.

9. Driver desires lower cruising speed, presses engagement switch fully, waits until car speed decreases to desired speed then releases switch--when the engagement switch is fully depressed the solenoid is de-energized causing the vacuum switch to bleed down the servo to idle throttle position and the "U" clip of the air bleed valve is released from the rubber drum. The drum and disc assembly is free to rotate to a position which corresponds to vehicle speed as the car slows. When the driver releases the engagement switch, the unit "pulls-in" and "holds-in" in the normal manner. The air bleed valve is clutched to the rubber drum at the car speed corresponding to switch release. Vacuum is again applied to the system and throttle control is assumed by the transducer to maintain the car speed at the time of switch release.

10. With system in operation, driver applies brakes--the electric release switch disengages the system first, then the vacuum valve operates. The Electric Release Switch cuts off power to the entire system, the solenoid and cruise light are de-energized, and the vacuum system is vented to atmosphere. The vacuum valve also can vent the system if the brake pedal is depressed far enough. When the driver removes his foot from the brake pedal the electric switch again feeds voltage to the engagement switch and the vacuum brake switch seals the air bleed line. The unit will not re-engage since it receives only a small current through the 40 ohm resistance wire. If vehicle speed is below 24 mph the system may not re-engage since the tang on the rubber drum has opened the low limit switch points in the transducer.

BACK TO INDEX

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DIAGNOSIS

1. Release Switches

The stop light switch and cruise control electrical brake release switch are combined into one unit.

Before any diagnosis of transducer operations, check the stop light-Cruise Control electric brake release switch adjustment. This switch must make contact in free position and break the electrical contact when the brake pedal is depressed 1/4 - 5/8 inch; but in any case it must be adjusted to disengage the system before the vacuum dump valve, otherwise a "hiss" will be heard inside the car when the brakes are applied.

A brief check of the electrical brake release switch is as follows:

1. Disconnect two-way connector on top of transducer.
2. Turn connector and install on terminal so that black wire terminal is temporarily connected to transducer "Hold" terminal. The other terminal will be empty.
3. With ignition switch on, move Cruise Control switch to ON.
4. Engage switch in turn signal lever, push button part way in (about 1/2 way) and hold. Green jewel next to "CRUISE" should light.
5. Depress brake pedal 1/4" to 5/8" while holding lever button depressed. "CRUISE" light should go out.

If light goes out before 1/4" travel or if light did not go on, the stop light-electric brake release switch at the brake pedal support bracket should be re-adjusted.

6. Turn ignition off, and adjust release switch as described in Section 5, Note 9.
7. Re-install two-way transducer connector on its proper terminals. It is imperative that this step be performed.

As a secondary release the vacuum brake release valve should disengage the system when the brake pedal is depressed over 1" of pedal travel. This will not de-energize the system; the "on-off" switch or ignition switch must be turned off when the car is stopped to disengage the system electrically.

This valve can easily be checked by:

(a) temporarily removing the smaller vacuum hose from the left front of the transudcer,

(b) removing the hose to the dump valve from the die-cast "tee,"

(c) connecting the two hoses together, so that engine vacuum is applied to the dump valve.

With the engine running a "hiss" should be heard when the brake pedal is depressed over 1". To adjust the dump valve, push valve all the way into the retaining

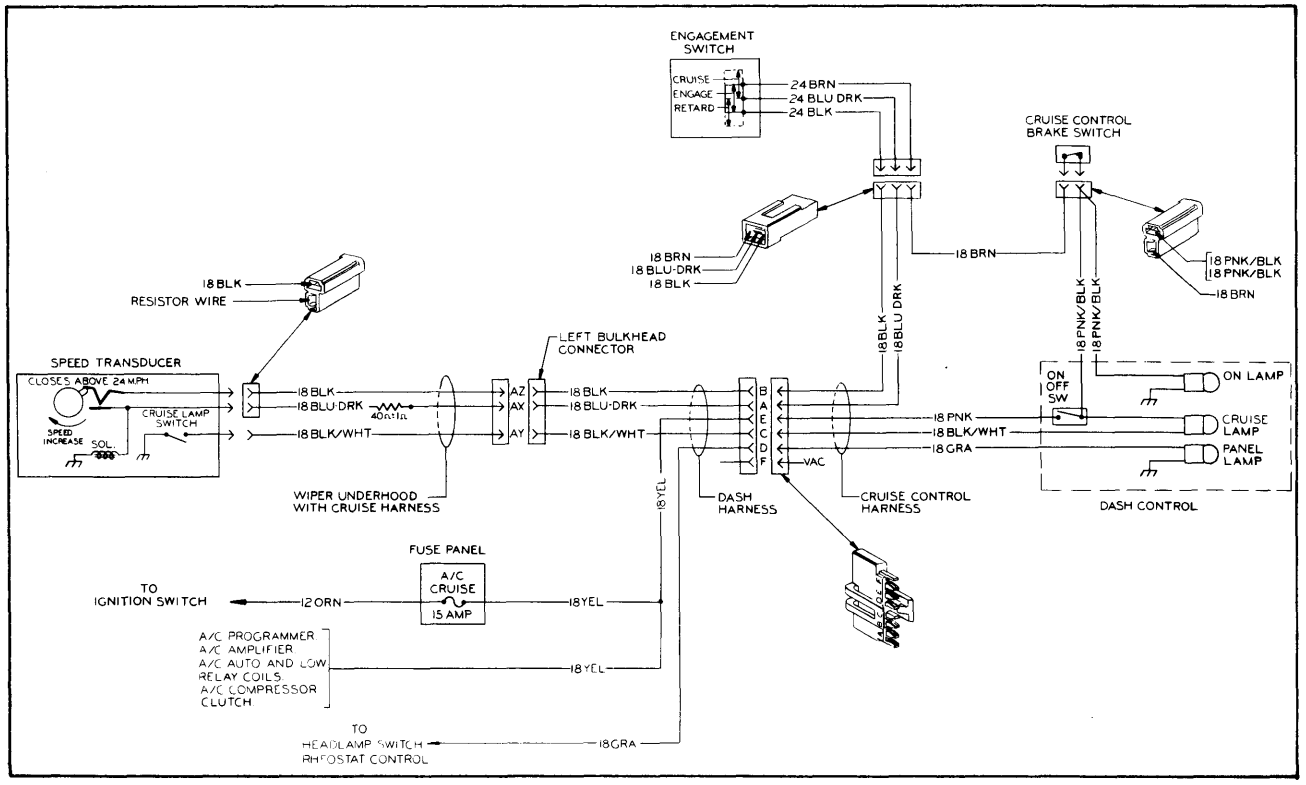


Fig 15-5 Cruise Control Circuit Diagram

BACK TO INDEX

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clip. Pulling the brake pedal up to the stop will automatically adjust the valve.

Make sure both hoses are reinstalled properly, when test is completed.

2. Electrical System Check (Fig. 15-5)

1. Check fuse and connector.

2. To check the cruise light circuit, refer to electrical schematic, Fig. 15-5 and:

(a) Turn ignition switch and cruise control switch on.

(b) Connect a jumper lead between light terminal connector on transducer and ground.

(c) If cruise light comes on, transducer replacement is indicated. If cruise light does not come on, check bulb, cruise light wiring and/or connections.

3. Check stop light electric brake switch as follows: Unplug connector at switch. Connect ohmmeter or self powered test light at two terminals on brake switch. The ohmmeter must indicate infinity when the pedal is depressed from 1/4" to 5/8" travel and continuity when pedal is released. Replace switch if malfunctioning.

4. Check engagement switch and connecting wiring as follows: Unplug engagement switch connector (brown, dark blue, black) at electrical wiring harness connector and perform the following tests. (See Fig. 15-5.)

a. Test #1 – Connect ohmmeter between terminal #1 (brown wire) and terminal #2 (dark blue wire). Continuity should be maintained until switch is depressed all the way in.

b. Test #2 – Connect ohmmeter between terminal #1 (brown wire) and terminal #3 (black). No continuity should be shown; however, when the button is depressed halfway, continuity should be indicated. When the button is depressed all the way down, no continuity should be shown.

c. Test #3 – Connect ohmmeter between terminal #2 (dark blue wire) and terminal #3 (black). Button released, no continuity; however, when the button is depressed partially and fully, continuity should be shown.

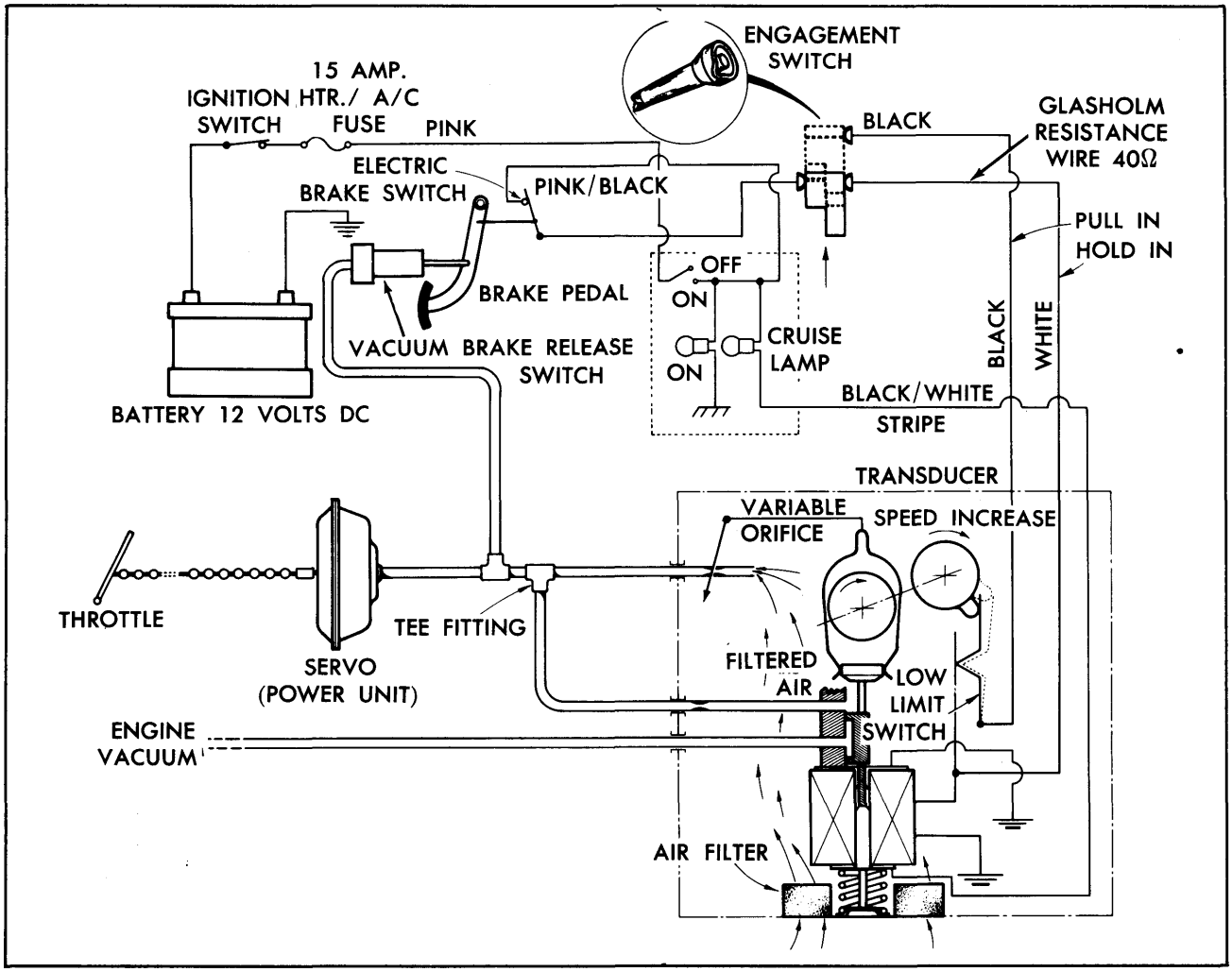


Fig. 15-6 Vacuum and Electrical Diagram

BACK TO INDEX

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5. Disconnect engagement switch wire harness connector from the main harness connector (brown, dark blue wire in main wire harness and ground. Make sure the transducer is well grounded to the chassis. The ohmmeter should read between 42 and 49 ohms. If a resistance either above or below the value indicated is shown, then disconnect the connector from the transducer and measure the resistance of the dark blue resistor wire. It should measure 40 ohms ± 2 ohms. If a resistance either above or below the value indicated is shown, the main wiring harness should be replaced.

(NOTE: When disconnecting or reconnecting the main wiring harness connector from the transducer, care should be exercised not to damage the blade connectors or the wiring harness. The disconnect may be facilitated by prying carefully on the plastic connector with a small bladed screwdriver.)

When measuring the solenoid coil circuit resistance between the hold terminal and ground, the ideal resistance should be between 5 and 6 ohms. A reading of less than 4 ohms indicates shorting in the coil circuit. A reading of more than 7 ohms indicates excessive resistance in the coil circuit. Either extremity necessitates replacement of the transducer assembly. The black main wiring harness from the switch to the transducer should also be checked for continuity.

BUTTON POSITION	TERMINALS		
	1 to 2	1 to 3	2 to 3
Cruise (released)	closed	open	open
Engage (Partially depressed)	closed	closed	closed
Trim (fully depressed)	open	open	closed

3. Servo and Vacuum Check (Fig. 15-6)

To determine the condition of the diaphragm, remove hose from servo unit and apply 14 inches of vacuum to the tube opening and hold in for one minute. The vacuum should not leak down more than 5 inches of vacuum in one minute. If leakage is detected, replace servo. To utilize engine as a vacuum source, proceed as follows:

1. Disconnect servo bead chain and hose from servo then connect engine vacuum directly to the servo fitting.
2. Note position of servo diaphragm.
3. Start engine - the diaphragm should pull in.
4. Clamp off engine vacuum supply line and check for leakage.

The cruise release brake switch (vacuum) and connecting hoses can likewise be checked using a vacuum pump.

BACK TO INDEX

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CRUISE CONTROL DIAGNOSIS CHART

CONDITION	CAUSE	CORRECTION
Will not engage - System Inoperative.	On-Off switch "off".	Turn to "on" position.
	Brake switch circuit open.	Check connections - adjust or replace switch. Refer to Electrical Check, Note 2.
	Fuse blown.	Replace fuse - if it blows again, check for: 1. Incorrect wiring - Refer to Electrical Check, Note 2. 2. Short to ground - Refer to Electrical Check, Note 2.
	Chain from servo to throttle linkage disconnected.	Connect chain.
	Inoperative engagement switch.	Replace as needed - Refer to Electrical Check, Note 2.
	Vacuum leak in servo and/or brake valve and connecting lines. Vacuum hose not connected to vacuum valve.	Vacuum test and repair or replace as needed. Refer to Servo and Vacuum System Check-Note 3.
	Vacuum release valve misadjusted (always open).	Readjust valve.
	Crossed hoses at transducer.	Reroute hoses.
	Pinched or plugged hose that is connected to the servo.	Free or replace hose.
	Open in wiring harness.	Repair or replace as needed.
	Inoperative transducer.	Replace transducer.
Does not cruise at engagement speed.	Orifice tube misadjusted.	Adjust as required.
System hunts, pulses, or surges.	Kinked or deteriorated hoses (air leak).	Repair or replace.
	Malfunctioning and/or improperly positioned drive cables and/or casing assemblies.	Repair or replace as needed.
	Malfunctioning transducer.	Replace transducer.
System does not disengage - with brake pedal.	Brake switch misadjusted or inoperative.	Adjust or replace as required. Refer to Servo and Vacuum System Check Out and Electrical Check, Notes 3 and 2.
System steadily accelerates or applies full throttle when engaged.	Manifold vacuum connected directly to servo. Malfunctioning transducer.	Reroute hose. Replace transducer.

BACK TO INDEX

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CRUISE CONTROL DIAGNOSIS CHART (Cont'd)

CONDITION	CAUSE	CORRECTION
Cannot adjust speed downward with engagement button.	Malfunctioning engagement switch or wiring.	Replace as needed. Refer to Electrical Check, Note 2.
Does not engage or engages lower than limits referred to in "Driver Operation". Low Speed Engagement can be as low as 20 MPH.	Malfunctioning transducer.	Replace transducer.
System operates correctly, but constant vacuum bleed when system is disengaged.	Crossed vacuum hoses at transducer.	Reroute hoses.
System can be engaged at idle by depressing switch, but will drop out when switch is released. Solenoid can be heard when switch is depressed when the vehicle is standing still.	Wires reversed at transducer.	Reverse wires - See Fig. 15-5.
On light will not turn on even though system cruises satisfactorily.	Inoperative bulb.	Replace.
Cruise light will not turn on even though system cruises satisfactorily.	Inoperative bulb or poor ground circuit in transducer.	Replace bulb check cruise light wiring and/or connections or replace transducer.
On light and switch illumination light inoperative.	Ground wire from jumper harness not connected to terminal on back of switch housing.	Connect ground wire.

BACK TO INDEX

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SERVICE INFORMATION

The component parts of the Cruise Control system are designed to be replaced should they become inoperative.

The transducer is calibrated in such a manner during manufacturing that overhaul operations are impractical. However, one adjustment may be made to the transducer to correct speed drop or increase at the time of engagement. (Refer to Note 7b and 7c.)

4. Brake Release Switch and Vacuum Dump Valve

a. Electric

Service – An inoperative switch must be replaced. Install new switch and adjust as described in Section 5, Note 9, stop light switch adjustment.

b. Vacuum

Service – An inoperative (sticking, plugged, or leaking) valve must be replaced. Be certain that the hose to the switch is connected firmly and is not cracked or deteriorated.

Adjustment – The vacuum valve should be pushed all the way into the retaining clip. Pull the brake pedal up to the stop to automatically adjust valve.

5. Engagement Switch

The engagement switch cannot be serviced. The complete turn signal lever must be replaced as an assembly.

a. Removal

1. Disconnect battery ground cable.
2. Remove steering column lower cover and slide column harness protector down out of way.
3. Disconnect cruise control switch harness connector and attach a long piece of piano wire to switch connector.
4. On T and T steering columns, perform the following:

a. Before unscrewing the turn signal lever, make a small hook in a thin piece of stiff wire.

b. Insert wire in turn signal lever opening.

c. Using wire, gently pull Cruise Control harness out through opening.

d. Gently pull remainder of harness up through and out of column.

e. Disconnect guide wire from connector and secure wire to column.

(NOTE: Wire must be used so that Cruise Control harness can be guided through the proper passages on installation.)

f. Unscrew turn signal lever, being sure to pass Cruise Control harness over the lever each time the turn signal lever makes one complete turn.

g. Remove turn signal lever from car.

5. On standard steering columns, proceed as follows:

a. Remove steering wheel as described in Section 9, Note 27a.

CAUTION: When laying wheel facing down, place a cloth on work bench to prevent wheel from being scratched or marked.

b. Remove three screws securing lock plate cover assembly to lock plate and remove cover assembly, Fig. 9-76.

c. Working through lock plate, remove screw securing turn signal lever and remove lever and harness. Pull harness up gently so guide wire can be used to install new unit.

6. On Air Restraint Steering columns, proceed as follows:

(a) through (e) and Note; same as used on T and T A.C.R.S. columns.

(f) Insert thin bladed screwdriver into column hole along turn lever and beneath turn signal switch retainer.

(g) Apply upward force on screwdriver to disengage spring locking tang, then pull lever out of retaining clip.

b. Installation

1. Attach upper end of piano wire to switch harness connector and pull piano wire at lower end of column, feeding harness into proper location in column.
2. On T and T steering columns, perform the following:

a. Gently pull harness down through steering column cover part way.

b. Allow Cruise Control lever to hang free, with approximately 16" of wire out of column. Then, rotate turn signal lever in a counterclockwise direction six times, permitting Cruise Control harness to make six loops.

c. Insert turn signal lever into opening in column.

d. Screw turn signal lever clockwise into position.

(NOTE: The wire loops will unwind as the lever is screwed in and wires will be straight in the column.)

e. After lever is installed, gently pull remainder of harness through column into position.

3. On standard steering columns, proceed as follows:

a. Position turn signal lever on turn signal switch. Working through lock plate, secure lever to switch with one screw. Tighten to 20 inch-pounds.

b. Position cover assembly on upper end of column and install three screws securing cover to lock plate.

c. Install steering wheel as described in Section 9, Note 27b.

d. Remove guide wire from switch harness.

4. On A.C.R.S. steering columns, proceed as follows:

(a) Same as T and T columns.

(b) Insert turn signal lever through column opening into retaining clip, making sure lever is fully inserted and clip locking tab engaged to prevent accidental removal.

(c) Same as (e) on T and T columns.

BACK TO INDEX

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5. Disconnect piano wire from switch harness and reconnect harness.

6. Slide column harness protector up into position and install steering column lower cover.

7. Connect battery ground cable.

6. Servo

a. Service

If the servo unit is found to be inoperative, replacement is required. Note the condition of the hoses and replace any which are cracked or deteriorated.

b. Adjustment

Install the bead chain with second ball on the inboard slot of the throttle plate clip.

7. Transducer

a. Maintenance

A malfunctioning transducer (one which is not simply out of adjustment) must be replaced. During replacement, check the hoses which connect to the transducer and replace any which are cracked or deteriorated.

b. Adjustment

One transducer adjustment is possible: Engagement - Cruising Speed Zeroing (to remove any difference between engagement and cruising speed). No transducer adjustment should be made, however, until the following items have been checked or serviced:

1. All hoses in good condition, properly attached, not leaking, not pinched or kinked.

2. Electric and vacuum release switches properly adjusted.

c. Engagement—Cruising Speed Zeroing

If the cruising speed is lower than the engagement speed, loosen the orifice tube locknut (see Fig. 15-2) turn the tube outward; if higher, turn the tube inward. Each 1/4 turn will alter the engagement-cruising speed difference one mph. Tighten the locknut after adjustment and check the system operation at 55 mph.

GUIDE-MATIC

THEORY OF OPERATION

The Guide-Matic is an optional convenience item that allows the driver to obtain automatic switching of vehicle headlight beams in response to light from approaching vehicle headlights. Provision is included for the driver to obtain manual control or constant low beam if desired.

The system consists of a photo-amplifier, power relay, foot switch, sensitivity control (driver control), and interconnecting wire harness, Fig. 15-7.

The photo-amplifier combines a light sensing photocell and transistorized D.C. amplifier into one unit with sufficient power to operate a power relay for switching the headlight beams. Mounting location is below the radiator cradle tie bar just to left of car center, positioned so the amber colored lens has an unobstructed view of approaching vehicle headlights through the grille. Road signs, reflections from the vehicle's own headlights, and other miscellaneous lights require the vertical and horizontal "viewing range" of the photocell to be rather narrow. Since the "viewing range" is narrow, aim of the photo-amplifier is very important. An adjustment screw and aiming level for setting correct vertical aim are integral parts of the unit. Instructions for aiming must be followed carefully for correct operation.

The photo-amplifier is adjusted and sealed at the factory. If a malfunction occurs, the assembly must be replaced. A model-serial number label is attached on the rear of the assembly for field identification.

The power relay is a sealed, single pole, double throw, 12 volt D.C. relay which provides the heavy-duty contacts for switching the headlight beams. The high beams are connected to the "normally closed" contacts. The relay is mounted on the cowl just to the left of the fuse block.

The foot switch is the same as the regular foot dimmer switch except for an added "momentary contact" grounding circuit. Operating the switch in the normal manner provides either "automatic" control of headlight beams or "low beam" only. In "automatic" position, a slight pressure on top of the switch closes the grounding circuit to provide an "overriding" high beam (regardless of light on the photo-amplifier) for signalling purposes or to determine "automatic" position.

The sensitivity control (driver control) is located directly behind and is concentric with the headlight switch knob. Rotating the ring pointer provides a range of sensitivity and is the only means of adjusting sensitivity in the field, Fig. 15-8.

Operation—Automatic

Turn headlights on, rotate driver control ring pointer to approximately center of rotation, and place foot switch in "automatic" position. If there is no light ahead, the headlights will be on high beam. No warm-up time is required.

BACK TO INDEX

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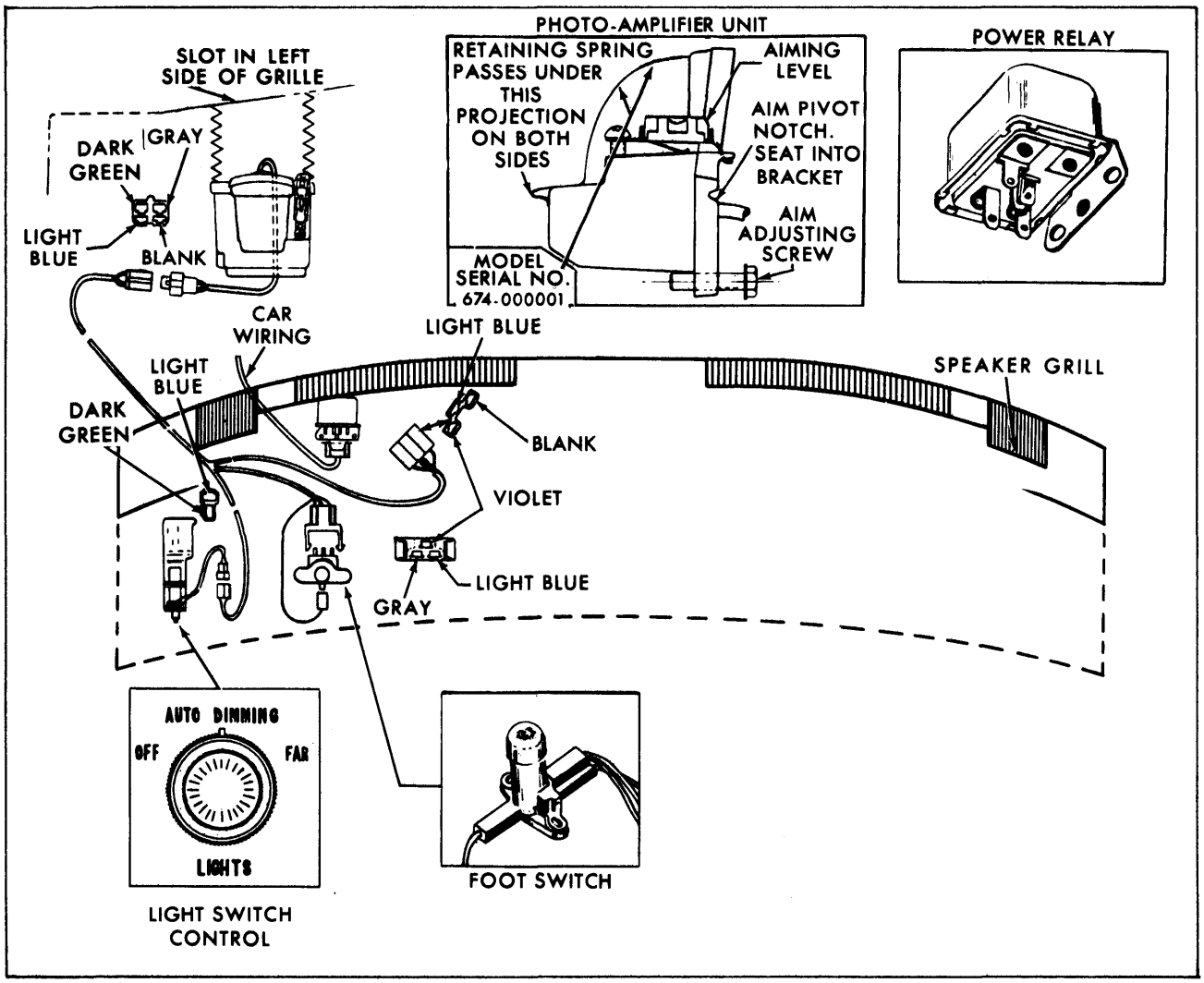


Fig. 15-7 Guide-Matic Components

When light from an approaching vehicle's headlights reaches a predetermined level at the photocell's sensing surface, the amplifier will trigger (pull-on) the power relay causing it to switch (dim) the headlights from high to low beam. At the same time the photocell sensitivity is increased to "hold" sensitivity to keep headlights on low beam when approaching driver reduces light by switching to low beam.

If the driver desires his lights to switch when the approaching vehicle is farther away or nearer, he may adjust the driver control. Also if the approaching driver fails to dim, he may signal him by momentarily putting a slight pressure on top of the foot switch to "override" his headlights to high beam. When he removes the pressure, his headlights will revert to low beam if there is still sufficient light ahead.

When the approaching car passes and light is removed from the photocell, the amplifier removes the signal voltage from the power relay coil, causing it to "drop out" and switch back to high beam.

If the road surface is highly reflective (snow, gravel, etc.), the unit may be held on low beam by reflections of its own headlights. If this occurs, slowly rotate driver control counterclockwise until lights return to high beam. This is maximum usable sensitivity for the particular road surface.

BACK TO INDEX

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Operation—Manual

Rotate driver control pointer to extreme counter-clockwise position (off) as indicated on left side of lens. The foot switch will now operate conventionally, switching headlights from high to low beam. High beam position will represent "automatic" position of the foot switch.

Operation—Low Beam

Place foot switch in "low beam" position. Headlights will remain on low beam until foot switch is changed to "automatic" position. Over-riding action is not available since power relay is disconnected from the photo-amplifier.

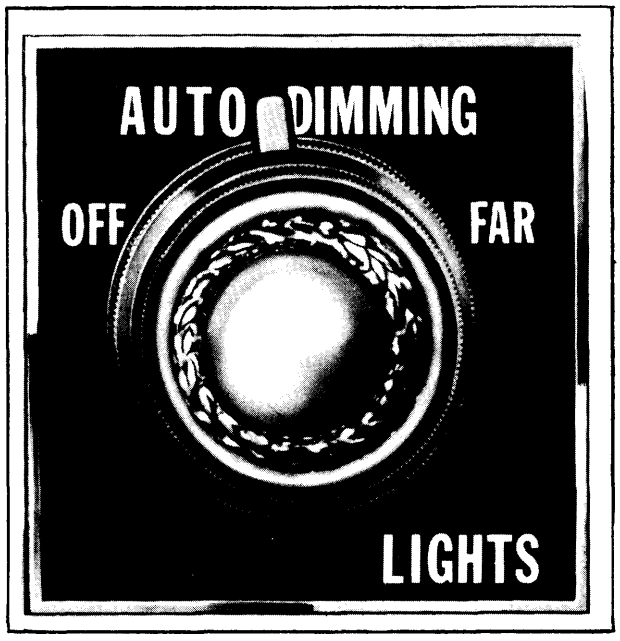


Fig. 15-8 Sensitivity Control Ring

DIAGNOSIS

8. Dim and Hold Sensitivity Test-On Car

The individual sensitivity controls for Dim and Hold are located in the photo-amplifier and are adjusted and sealed at the factory so they are not accessible in the field. The sensitivity check is only to determine if the driver control can be adjusted to provide the driver at least a minimum acceptable dimming sensitivity (switch to low beam) and at the same time provide an acceptable hold sensitivity (point of return to high beam).

1. Preparation for Test

a. Use Guide-Matic Analyzer, J-21529, with Guide-Matic Analyzer Adapter, J-22622. Since an individual test bulb is no longer incorporated in each photo-amplifier, it is necessary to adapt the present analyzer test bulb assembly (previously designed for use with the Twilight Sentinel) to supply a calibrated light source. A dome-shaped filter is glued into the adapter to reduce light to a level consistent with Guide-Matic sensitivity. The test bulb assembly plugs into the rear of the adapter head. If bulb burns out, replace with a #53 bulb. Make sure filament of bulb is standing fairly straight up so that a minimum of the side of the filament is exposed to the end of the bulb. The end of the bulb should be approximately flush with the end of its rubber sleeve.

b. Install analyzer test bulb assembly into smaller diameter hole in rear of adapter head. Push bulb and rubber sleeve forward until they stop against inner bulkhead wall of adapter head, Fig. 15-9.

c. Install and connect analyzer as shown in Fig. 15-9. (It will be necessary to remove the light baffle boot.) Make sure adapter is seated snugly around lens and bail is snapped tightly into position. Do not disconnect electrical connectors.

d. Wrap photo-amplifier and adapter with black cloth to eliminate any outside light.

e. Rotate analyzer function selector switch to #1 position.

f. Rotate driver control ring pointer counterclockwise to "off" position.

g. Turn on headlights and operate engine at fast idle.

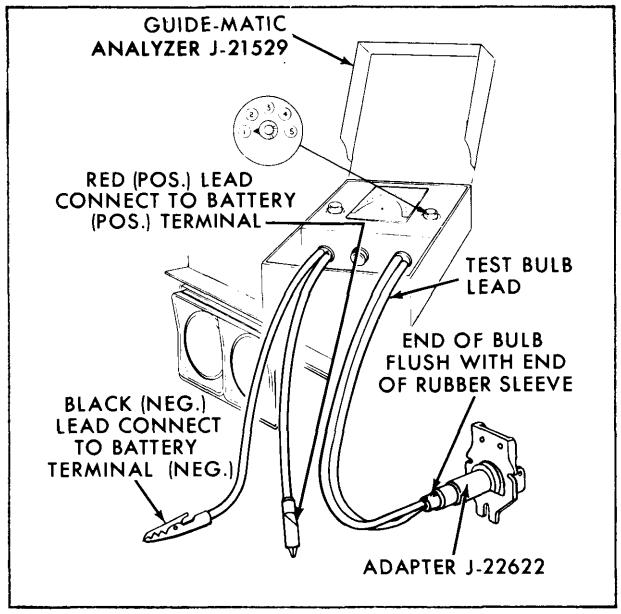


Fig. 15-9 Dim And Hold Sensitivity Test

BACK TO INDEX

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h. Place foot switch in automatic position. (Headlamps at high beam.)

2. Test Procedure

a. Adjust analyzer voltage control knob until meter reads 7.0 volts.

b. Slowly rotate driver control ring clockwise just to point where headlights switch to low beam.

c. Check accuracy of driver control adjustment by rotating analyzer voltage control knob counterclockwise until headlights switch to high beam. Then slowly rotate analyzer voltage control knob clockwise until headlights switch to low beam. Voltmeter should read between 6.5 and 7.0 volts.

d. If reading does not agree, repeat Steps a, b, and c.

e. Rotate anlayzer voltage control knob counterclockwise to a reading that is 1.0 volt less than reading obtained for switching to low beam in Step c. Wait four seconds. Headlights should not switch to high beam. Rotate analyzer voltage control knob counterclockwise to a reading that is 3 volts less than reading obtained for switching to low beam in Step c. Headlights should switch to high beam within four seconds.

f. If this minimum dim and hold sensitivity can be obtained at any position of the driver control ring, the unit is acceptable for sensitivity and you may proceed to Step g. If dim (switching to low beam) sensitivity cannot be adjusted (Step b), see Fig. 15-10 and check for open circuit to driver control or malfunctioning driver control. If o.k., replace malfunctioning photo-amplifier.

g. Turn off engine, disconnect analyzer, reconnect any wires previously disconnected, remove black cloth from photo-amplifier and reinstall light baffle boot. If it was necessary to remove photo-amplifier from bracket, reinstall and perform vertical aiming adjustment as described in Note 9.

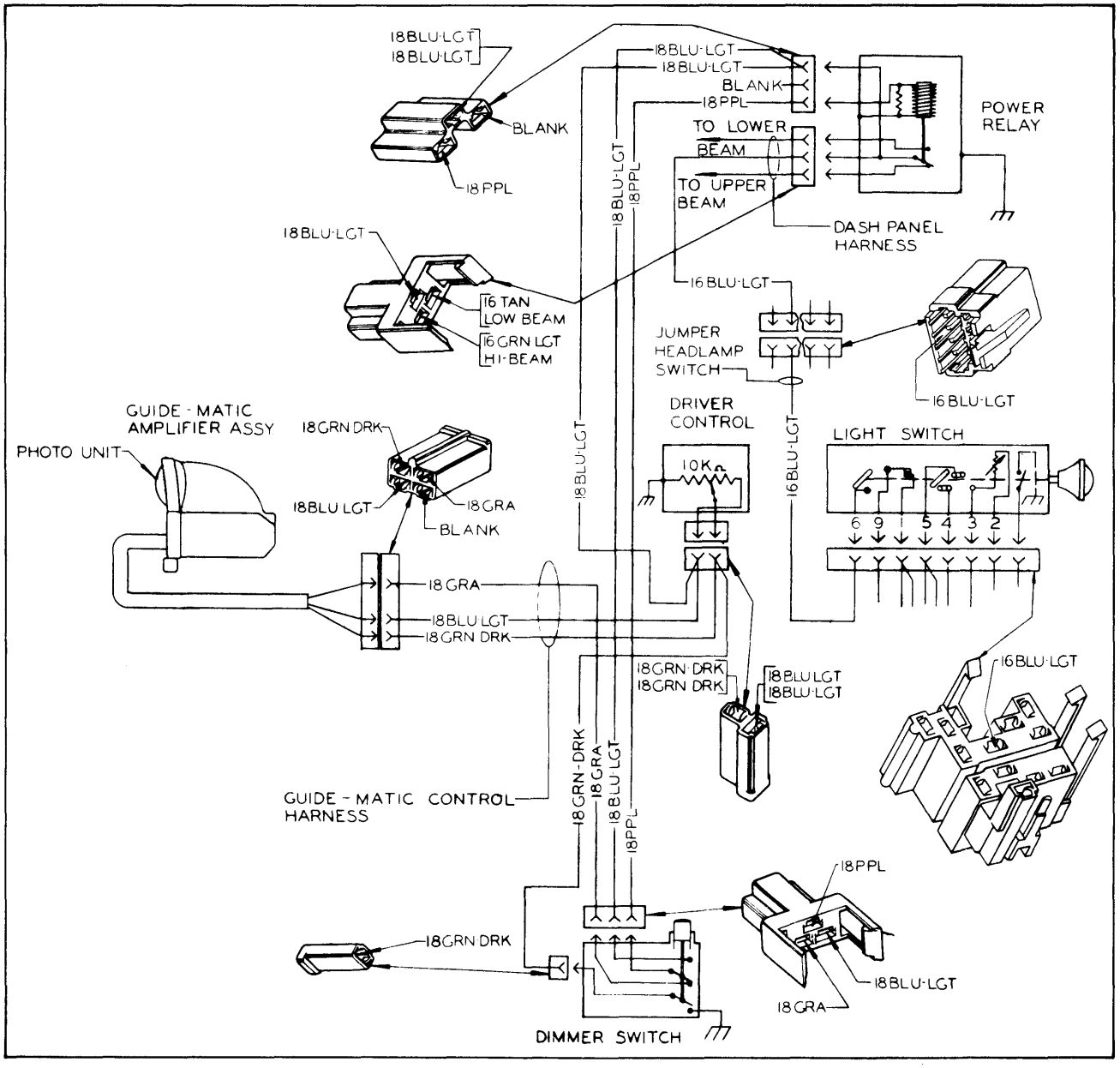
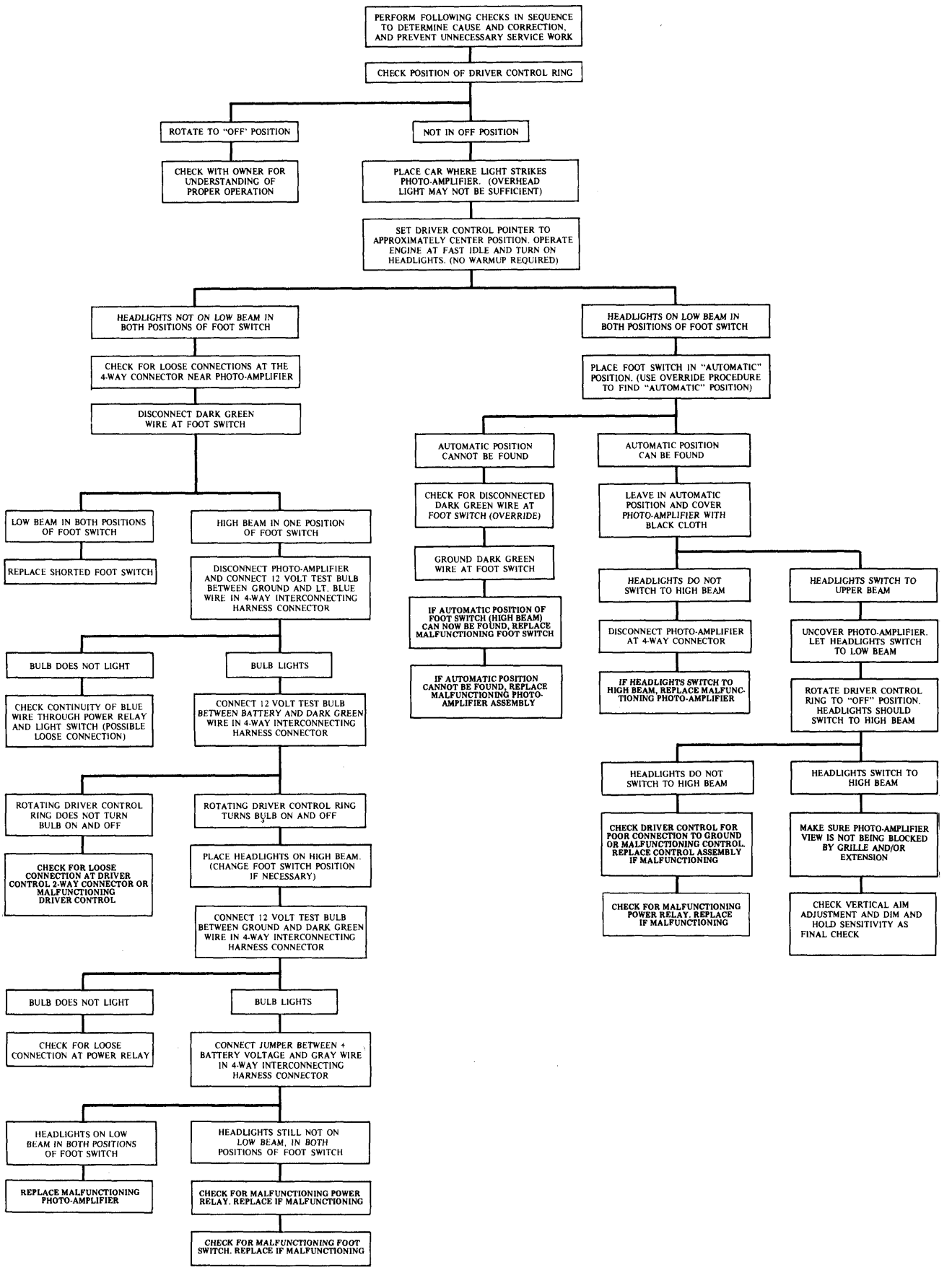


Fig. 15-10 Guide-Matic Circuit Diagram

BACK TO INDEX

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GUIDE-MATIC DIAGNOSIS CHART



BACK TO INDEX

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SERVICE INFORMATION

9. Vertical Aiming Adjustment

Accurate vertical aim is essential to proper performance of the Guide-Matic system. If the photo-amplifier is aimed too low, reflected road light from the vehicle's own headlights can cause the Guide-Matic to be slow in returning headlights to high beam or hold them on low beam. The unit must be aimed as low as possible, however, to provide maximum tolerance for car loading, Fig. 15-11.

1. Photo-amplifier vertical aiming should be performed with vehicle unloaded, trunk empty except for spare tire, gas tank at least half full, and tires at correct pressure.

(NOTE: It is not necessary to comply with car load or trunk load specifications if vehicle is equipped with Automatic Level Control.)

2. Locate vehicle on level floor (level within 1/4 inch fore and aft).
3. Rock car sideways and up and down to equalize springs.
4. Raise car hood for access to photo-amplifier.
5. Adjust vertical aiming screw at front of photo-amplifier until bubble is centered in the level assembly.

10. Sensitivity Control Switch

The procedure for removing and installing the Guide-Matic sensitivity control switch is described in Section 12, Note 79.

11. Photo-Amplifier Unit

a. Removal

1. Disconnect negative battery cable at battery.
2. Disconnect four-way (3 wire) electrical connector near photo-amplifier.

CAUTION: Do not pull on cable sheathing otherwise leads could be damaged.

3. Loosen screw securing photo-amplifier unit to mounting bracket and release retaining spring.
4. Carefully remove photo-amplifier unit from mounting bracket.

b. Installation

1. Connect retaining spring to photo-amplifier unit.
2. Install photo-amplifier unit on mounting bracket and secure with screw.
3. Connect four-way (3 wire) electrical connector near photo-amplifier.

(NOTE: Make sure connector is firmly installed.)

4. Connect negative battery cable at battery.
5. Adjust vertical aim as described in Note 9.

(NOTE: Vertical aiming adjustment is essential for proper operation.)

12. Power Relay Unit

a. Removal

1. Disconnect negative battery cable at battery.
2. Disconnect two three-way electrical connectors from power relay unit.
3. Remove two screws that hold power relay unit to cowl and remove unit.

b. Installation

1. Position power relay unit to cowl and secure with two screws.
2. Connect two three-way connectors to power relay unit.
3. Connect negative battery cable to battery.

13. Foot Switch

a. Removal

1. Disconnect negative battery cable at battery.
2. Remove left side kick pad.
3. Remove rubber boot from foot switch.
4. Partially raise floor carpet to gain access to foot switch.
5. Disconnect one-way and three-way electrical connectors at foot switch.
6. Remove two screws that hold foot switch to floor pan and remove foot switch.

b. Installation

1. Install foot switch on floor pan and secure with two attaching screws.
2. Connect one-way and three-way connectors to foot switch.

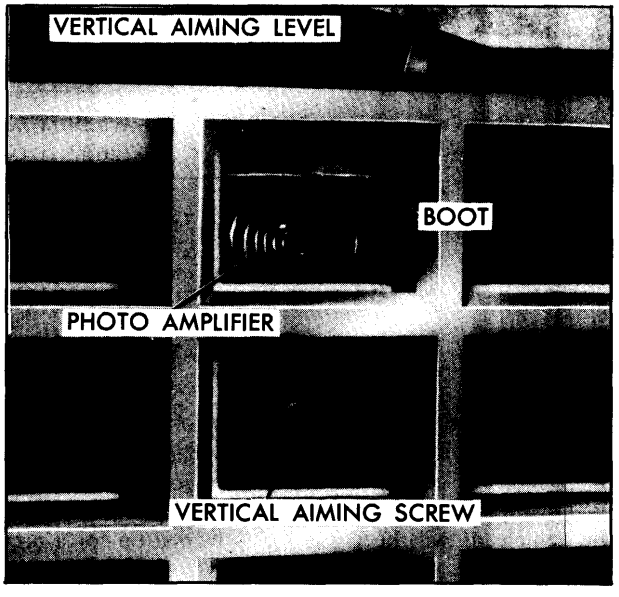


Fig. 15-11 Vertical Aiming Adjustment

BACK TO INDEX

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3. Reposition floor carpet and install left side kick pad.
4. Install rubber boot on foot switch.
5. Connect negative battery cable to battery.

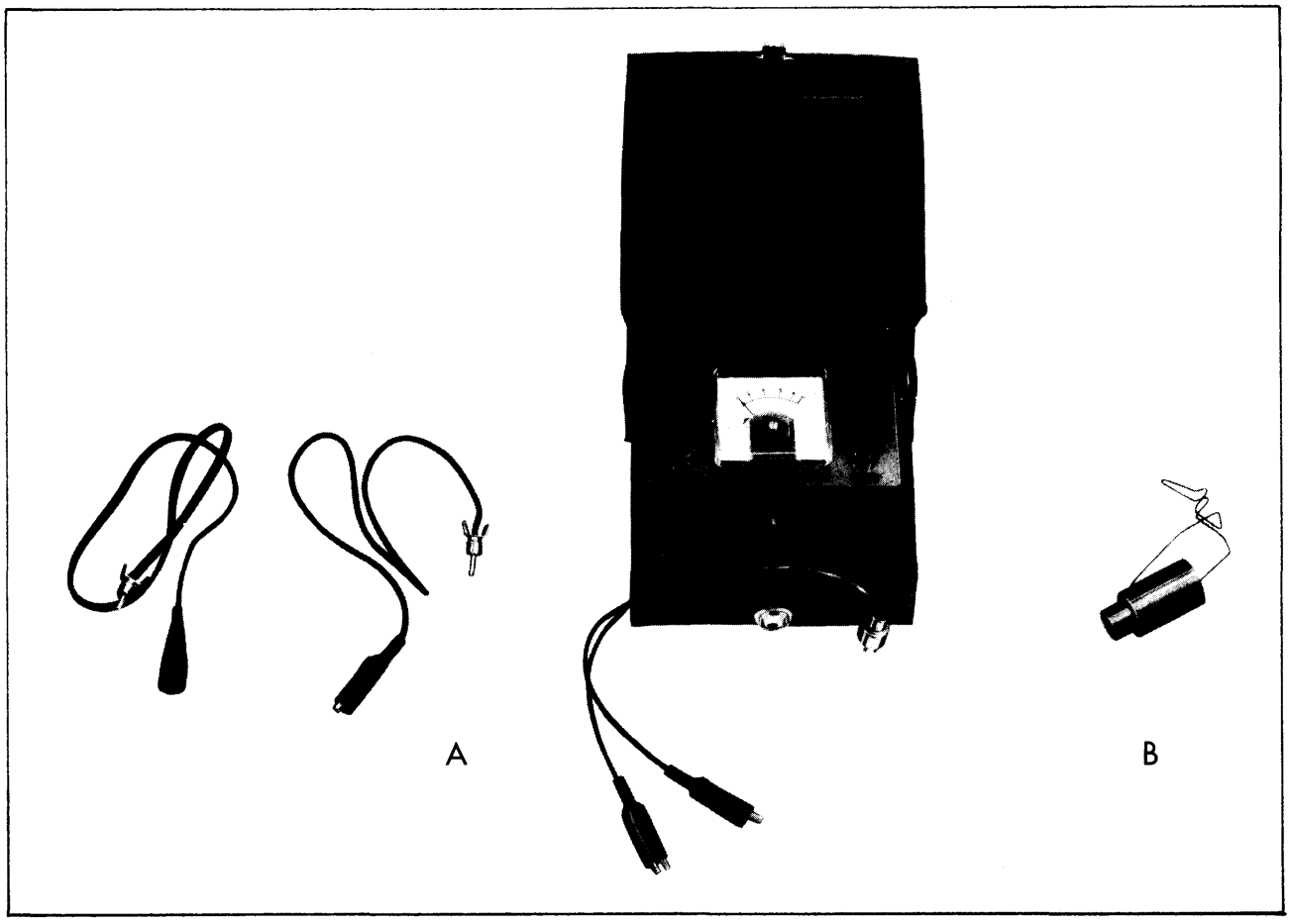


Fig. 15-12 Special Tools—Guide-Matic

Key	Tool No.	Name
A	J-21529	Guide-Matic Analyzer
B	J-22622	Guide-Matic Analyzer Adapter

TWILIGHT SENTINEL
THEORY OF OPERATION

The Twilight Sentinel is an optional convenience item that provides an ambient light-sensitive automatic on-off control of the lights normally controlled by the light switch. In addition, for night visibility when leaving the vehicle, it will keep the lights turned on for a pre-selected period of time after the ignition is turned off. Lights will turn off automatically after this pre-selected time period elapses.

The system consists of a light sensitive photocell assembly, transistorized amplifier, and a time delay control which includes an on-off switch, Fig. 15-13. Connections to the vehicle lights parallel the regular light switch connections therefore requiring the light switch to be turned off to obtain automatic control.

The photocell assembly is mounted with its sensitive surface face up, to obtain an unobstructed view of sky-

BACK TO INDEX

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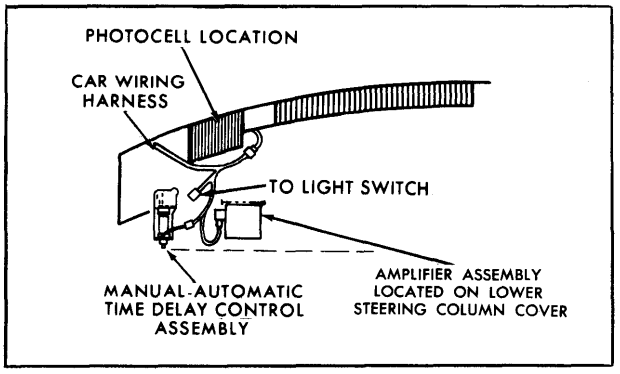


Fig. 15-13 Twilight Sentinel Components

light through the windshield. Mounting location is under the left front speaker grille.

The amplifier unit is mounted on the lower instrument panel brace with a serial number label attached to the side facing the fuse block.

The time delay and on-off switch control is located directly behind and concentric with the regular light switch knob, Fig. 15-14.

The electrical circuit for the Twilight Sentinel is shown in Fig. 15-15.

Operation—Automatic

The Twilight Sentinel system will operate automatically when the following conditions are met: the ignition switch must be on, the headlight switch must be off, and the control ring pointer, Fig. 15-14, must be turned on (any position on the dial counterclockwise from "OFF" position). The system will now turn lights on automatically when daylight reduces to the point at which road illumination becomes necessary. As daylight increases in the morning to the point at which illumination is no longer necessary, it will turn lights off.

A time delay circuit in the amplifier reduces the possibility of undesired switching on or off of lights while passing under viaducts, trees, bright lights, etc. The time delay is nominally 10 to 30 seconds, but in some units it could be as high as 60 seconds. The length of the time delay is set in production and cannot be altered in the field.

The variable time delay control ring adjusts only the time delay period during which the lights will remain on after ignition is turned off. The driver may preselect any desired time delay from a few seconds to a maximum of 1 1/2 to 4 1/2 minutes.

Additional side lighting can be obtained by turning on a cornering light.

Operation—Manual

Should there be an occasion when lights are undesirable such as in tunnels requiring lights off, or if Twilight Sentinel malfunctions, rotate time delay turn-off control ring pointer to "Off" position. This disables the Twilight Sentinel by disconnecting the ground circuit. Lights will now operate only by use of the regular light switch.

If lights are desirable during daylight hours, the driver can use either of two methods:

1. Turn on lights by operating regular light switch. The headlight switch is wired in parallel with the Twilight Sentinel. This bypasses the system whether the control ring pointer is on or off. If this method of manual operation is selected, lights will remain on after the ignition is turned off; however, when the driver opens the door to leave the car, a warning buzzer grounded through the door jamb switch reminds the driver to turn off the lights if the ignition switch is turned off.
2. Cover the photocell to block light exposure. This will cause the lights to turn on and still permit the Twilight Sentinel to turn lights off in the normal manner when ignition is turned off. (If cell has been exposed to light, the time delay must elapse before lights will turn on.)



Fig. 15-14 Twilight Sentinel Control Lever

SERVICE INFORMATION

14. Operation and Correction

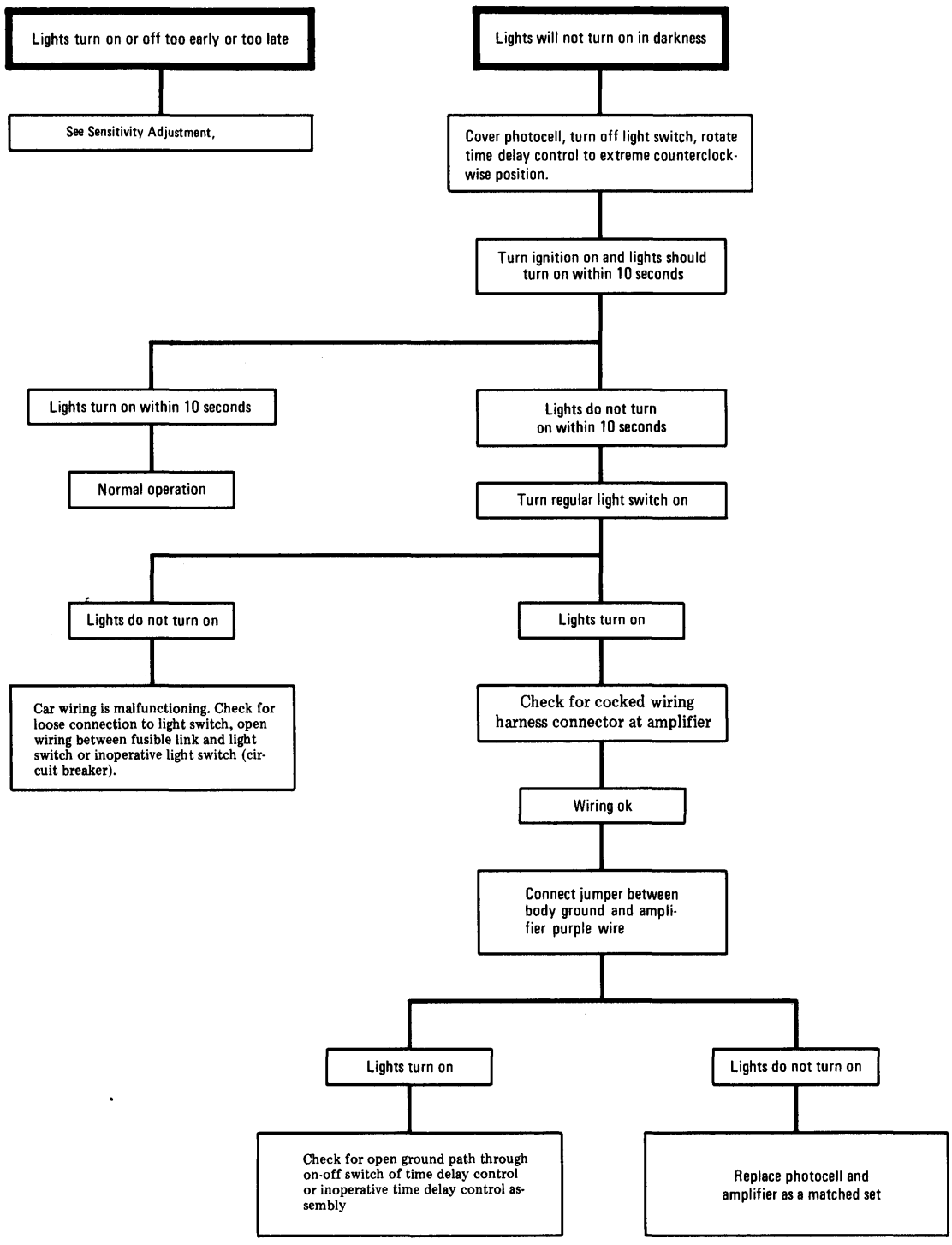
a. Twilight Sentinel Check List

1. Make sure photocell opening located in front LH speaker grille is unobstructed and the headlight switch is in "Off" position.
2. Adjust Twilight Sentinel control ring midway between "Off" and "Max".

BACK TO INDEX

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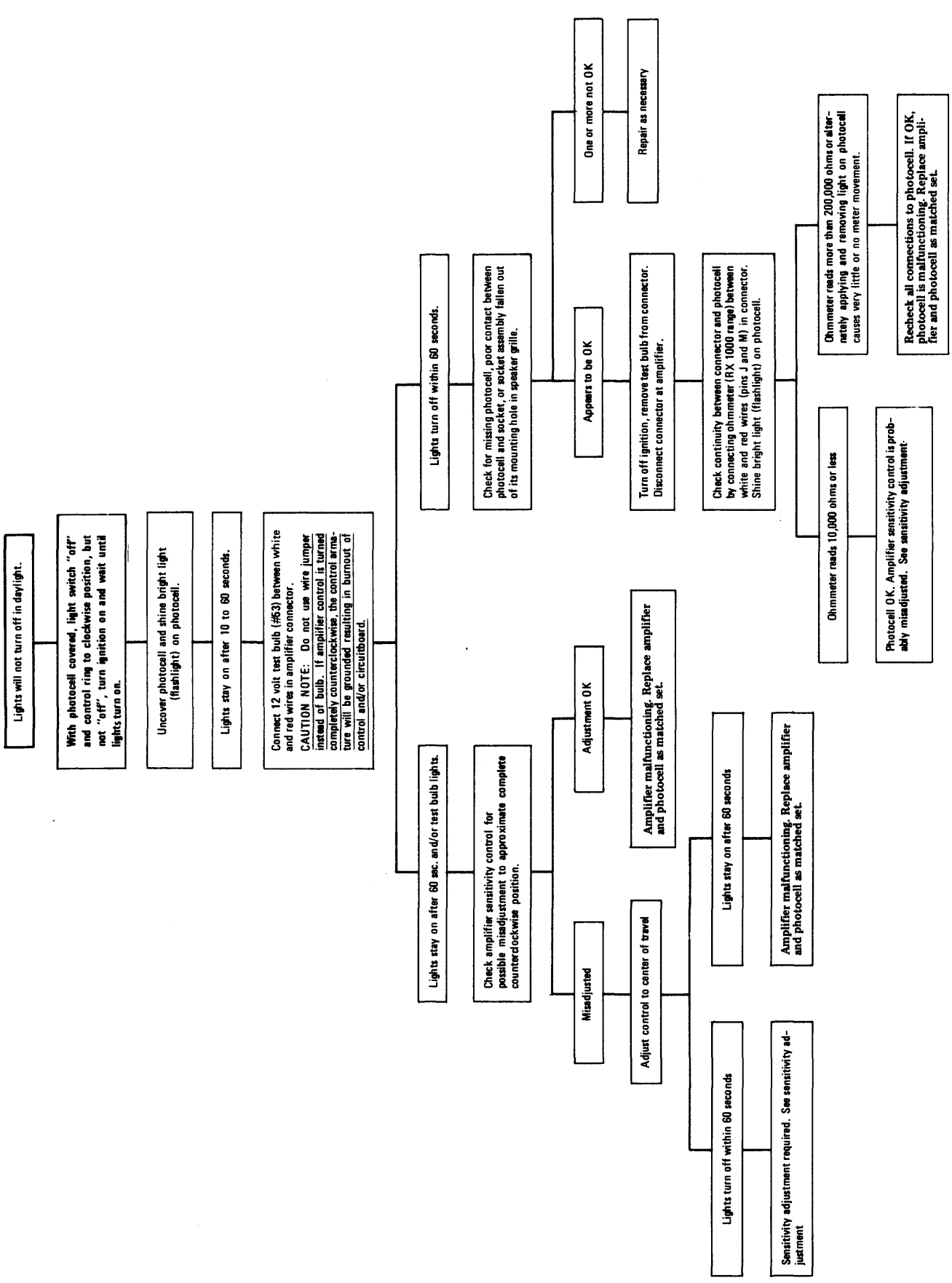
TWILIGHT SENTINEL DIAGNOSIS CHART



BACK TO INDEX

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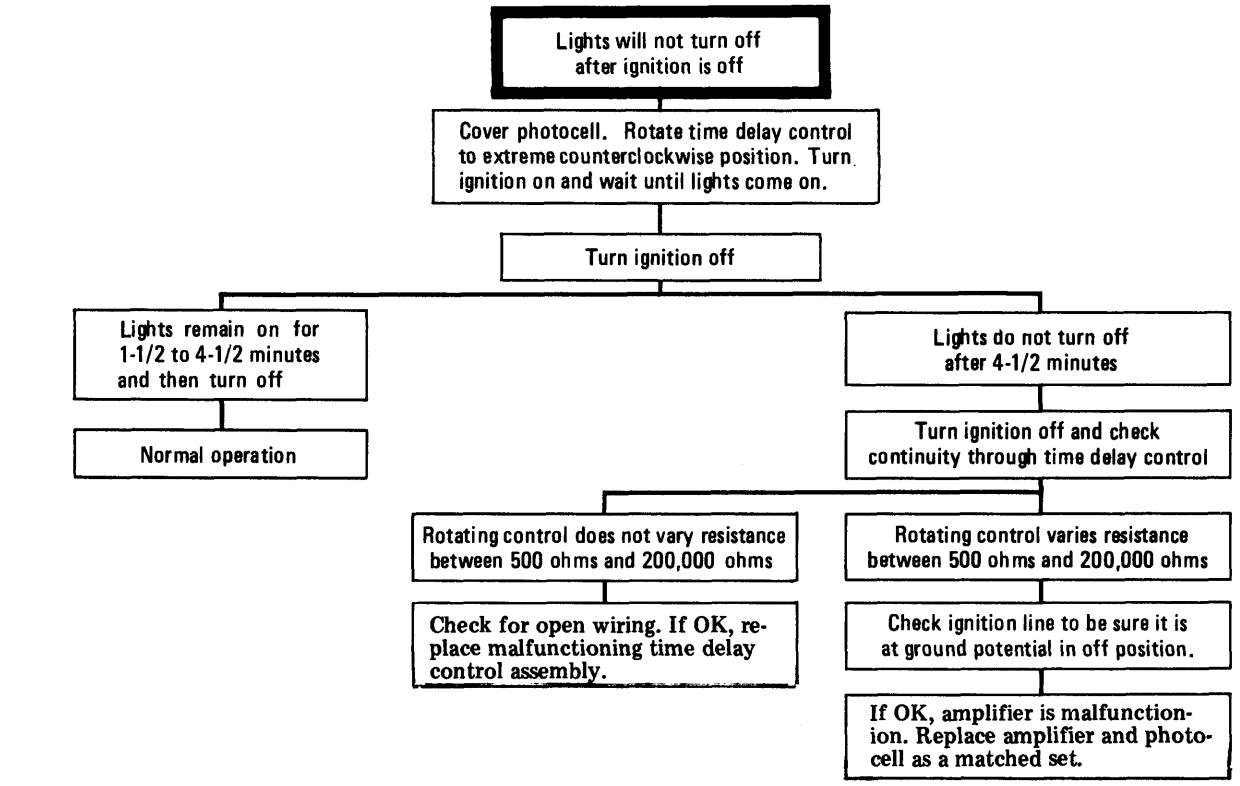
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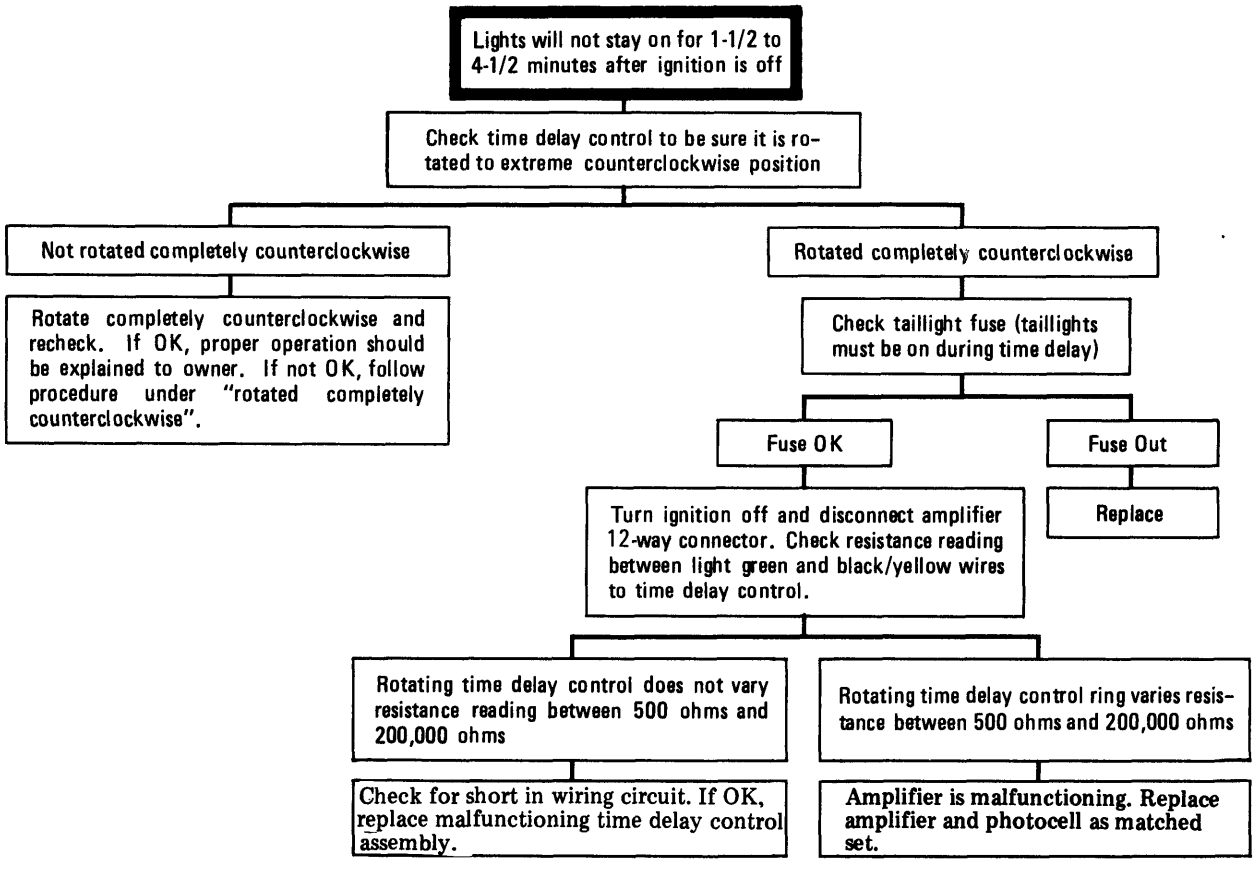


BACK TO INDEX

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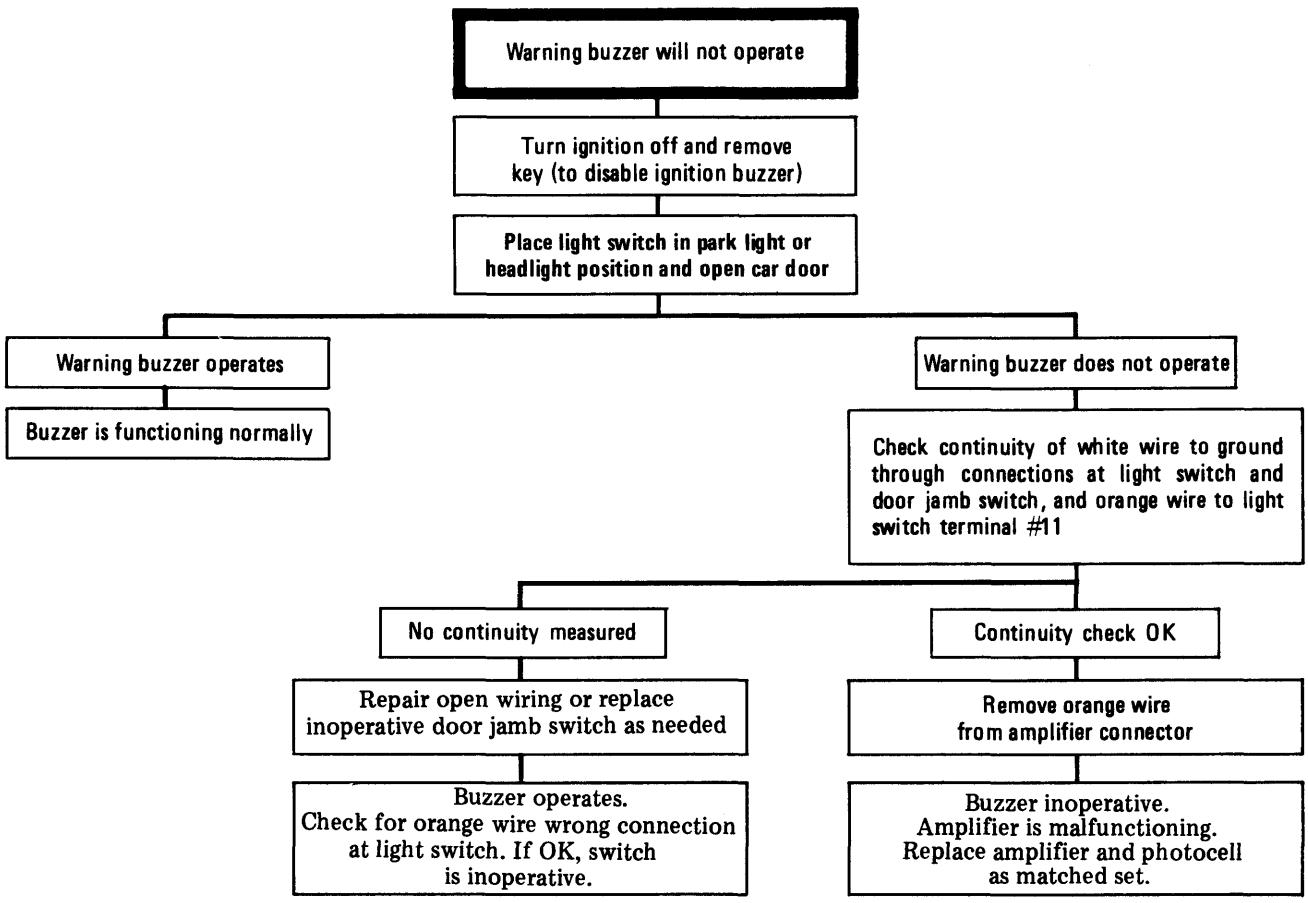


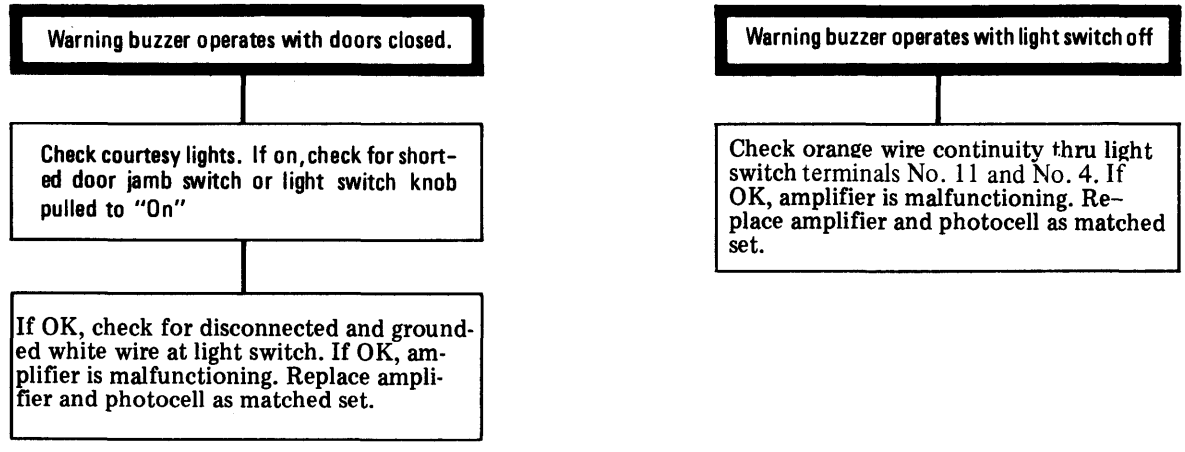


BACK TO INDEX

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BACK TO INDEX

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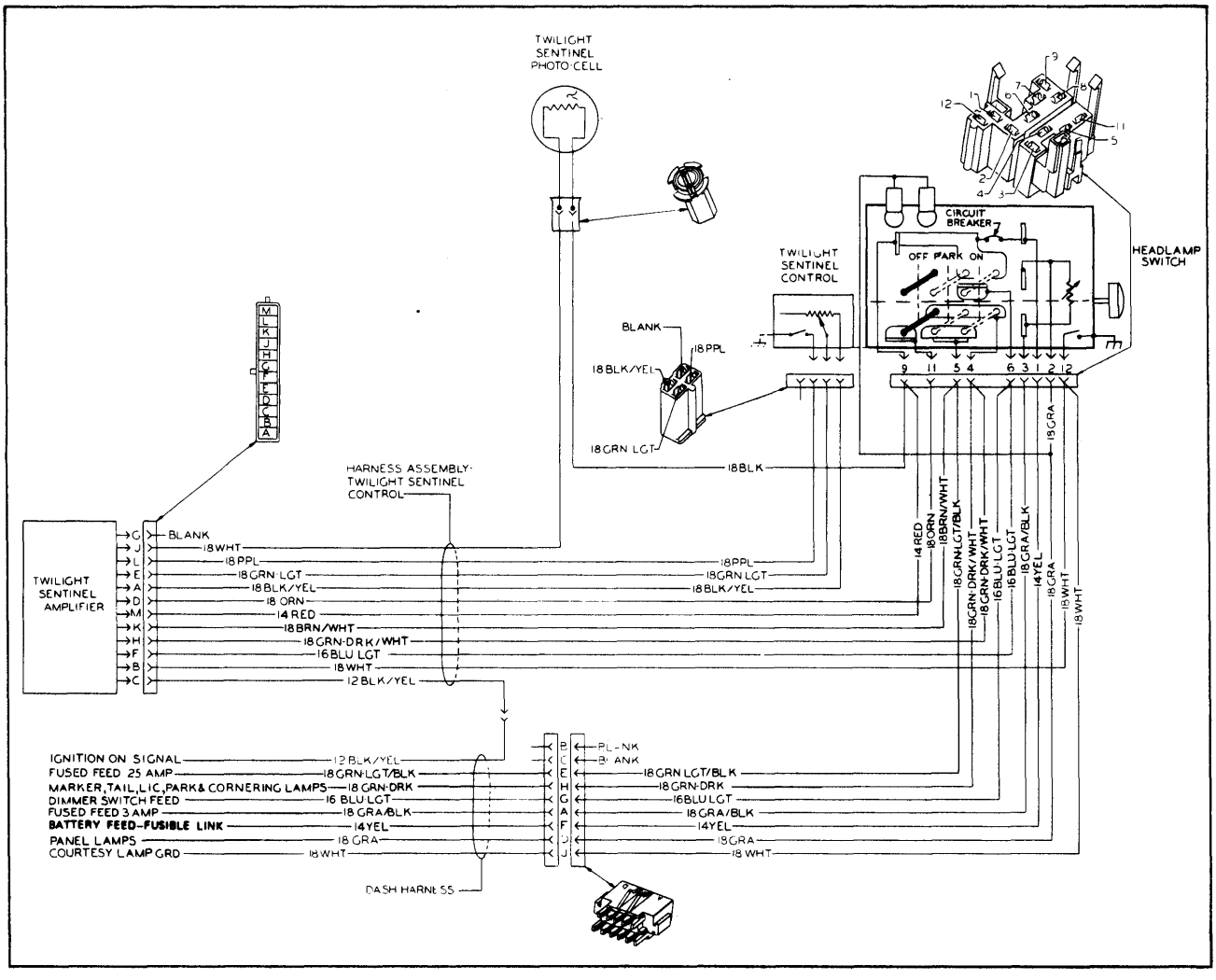


Fig. 15-15 Twilight Sentinel Circuit Diagram

3. Hold lighted flashlight or trouble light directly over photocell opening.

(NOTE: Failure of the Twilight sentinel to comply with steps 4, 5a, 5c, or 8 below indicates a malfunctioning unit. In such a case, replace Twilight Sentinel amplifier and photocell unit.)

4. Turn ignition key to "On" position. Headlights and taillights must remain off.

5. Remove flashlight or trouble light and cover photocell opening with a heavy dark cloth:

a. Headlights and taillights must turn "On" within one minute.

b. Turn ignition switch to "Off" position.

c. Headlights and taillights must turn "Off" (within 3 minutes normally).

6. Remove cloth cover from photocell opening.

7. Pull headlight switch out to "On" position.

8. Open left front door. Warning buzzer must sound.

b. Headlights Turn On in Daylight When Ignition is Turned On

Some cars equipped with Twilight Sentinel may experience a condition where the headlights turn on in daylight when the ignition is turned on.

Whenever this happens, the most likely cause is a "disconnect" or "open" in the photocell leads, or the photocell itself has dropped from its mounting hole in the radio speaker grille and is laying somewhere in darkness under the instrument panel top cover (thus the lights go on, even in daytime).

A connected photocell will show resistance anywhere from 3,000 to 50,000 ohms (3 to 50 on the Rx1K scale) depending on the light level in the shop. If the resistance reading varies when the photocell is covered, connections in the lead wires are okay.

An open circuit will be indicated by a maximum reading (usua∞ ∝ infinity reading on the meter). If an open is indicated, check to see if the photocell wires are making contact in the photocell socket.

BACK TO INDEX

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15. Sensitivity Adjustment

If a photocell or amplifier is malfunctioning, both must be replaced as a matched set since no provision is made for adjusting a mismatched set. However, if the owner is dissatisfied with evening turn-on time or morning turn-off time, a recommended procedure to advance or retard turn-on time by 15 minutes is given below:

a. Headlights Turn On Too Late In Evening (Or Off Too Early In Morning)

1. Leave ignition and lights turned off.
2. Cover photocell so no light strikes it.
3. Take resistance reading between J and L terminals in amplifier connector.
4. See Fig. 15-16. Adjust control screw clockwise until resistance reads one-half of value read in Step 3.
5. If amplifier has been previously adjusted set resistance value to 4100-4500 ohms.

b. Headlights Turn On Too Early In Evening (Or Off Too Late In Morning)

Follow same procedure as described in Steps 1 through 5 above except under Step 4 adjust control screw counterclockwise until resistance reads one and one-half times value read in Step 3.

16. Control Switch

The procedure for removing and installing the Twilight Sentinel control switch is described in Section 12, Note 79.

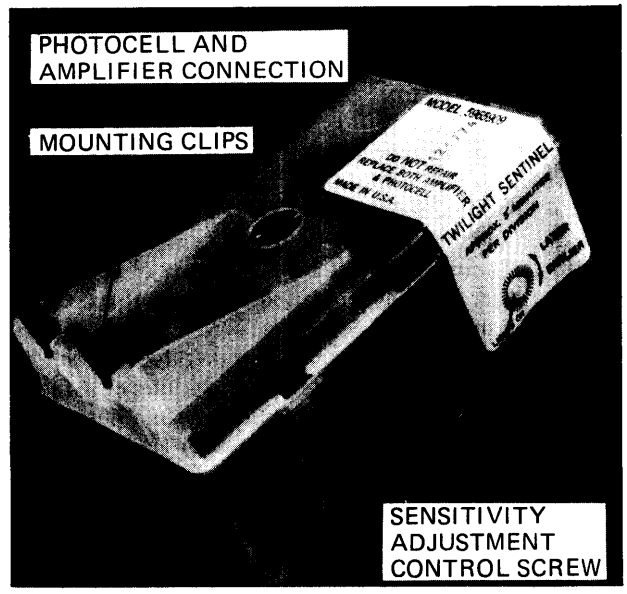


Fig. 15-16 Sensitivity Adjustment Control Screw

17. Photocell Unit

The procedure for removing and installing the Twilight Sentinel photocell unit is described in Section 12, Note 65.

18. Amplifier Unit

The procedure for removing and installing the Twilight Sentinel amplifier unit is described in Section 12, Note 66.

REAR WINDOW DE-FOGGER

THEORY OF OPERATION

The rear window De-Fogger option is available as a factory installed accessory, on all body styles except the Fleetwood Seventy-Five and Commercial Chassis.

The De-Fogger on Fleetwood Seventy-Five styles is integral with the rear air conditioning unit, which is standard equipment. The De-Fogger operates whenever the rear air conditioner is operating in the heater mode. For additional information on this unit refer to Section 1 of this manual.

A rear window De-Fogger is not offered for the Commercial Chassis.

The rear window De-Fogger is an electrically heated back light. It does not use a blower motor, hoses or ductwork. The circuit diagram is illustrated in Fig. 15-18.

The switch for controlling the De-Fogger is located in the accessory switch panel, to the right of the steering column. Momentarily moving the spring loaded switch to the "ON" position energizes a time-delay relay, located on the left side of the lower steering column support. The time-delay relay is fed current from the fuse block through a 25 amp. circuit breaker. Current then flows from the relay to the heated back light. The heated back light consists of silver ceramic electrically conductive horizontal grid lines. When the grid lines are subjected to current flow, they heat the glass and remove fog from the glass surface.

A green indicator light in the switch is illuminated whenever the De-Fogger is operating. When the switch is pulsed on, the relay allows current to flow for approximately ten minutes, then shuts off. Additional periods of heating operation can be obtained each time the switch is pulsed on. Pulsing the switch "ON" while the De-Fogger is in operation will not extend the heating period beyond the normal delay cycle. The De-Fogger must shut itself off before it can be re-energized. The De-Fogger can be manually shut off at anytime during its time delay cycle; by momentarily moving the control switch to the "OFF" position. Turning off the ignition switch also turns off the De-Fogger.

BACK TO INDEX

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DIAGNOSIS

19. De-Fogger Test

This test is designed as an on car check using a non-powered test light.

1. Turn ignition key to "ON" position and pulse de-fogger switch to "On" position. Rear window glass should feel warm to touch after 3 minutes of operation. If so, explain de-fogger operation to owner. If glass does not feel warm, proceed.
2. Check de-fogger circuit breaker located in the yellow wire; between the fuse block and jumper harness. If malfunctioning, replace and check system operation.
3. Disconnect single wire connector (red wire from black wire) located behind instrument panel to left of steering column. Leaving ignition key in "On" position, pulse de-fogger switch to "On". Connect test light from red wire to ground. If test light and de-fogger switch indicator light come on, the rear window circuit is open. This open may be the connector (black wire) to the heating element lead, the heating element or the ground wire attachment. Reconnect wiring connector. If light does not light, proceed with check.
4. Remove lower steering column cover to gain access to timer relay located on the left side of the instrument panel lower support. Remove wiring connector from relay. With ignition key in "On" position, connect test light between the yellow wire in the connector and ground. Test light should light. If test light does not light, the 3-way connector or the switch is malfunctioning. If light comes on, proceed with check.
5. Reconnect wiring connector to timer relay. Leaving ignition key in "On" position, connect test light between "L" terminal on relay (red wire) and ground. Pulse de-fogger switch to "Off" to cancel time delay cycle of relay. Pulse de-fogger switch to "On" position, starting new time delay cycle, and release. Test light should light. If checks did not perform as outlined in this step,replace timer relay and check system operation.
6. If all previous checks do not locate cause of inoperative condition, test de-fogger switch using procedure outlined in Note 20 of this section.

20. De-Fogger Switch Test

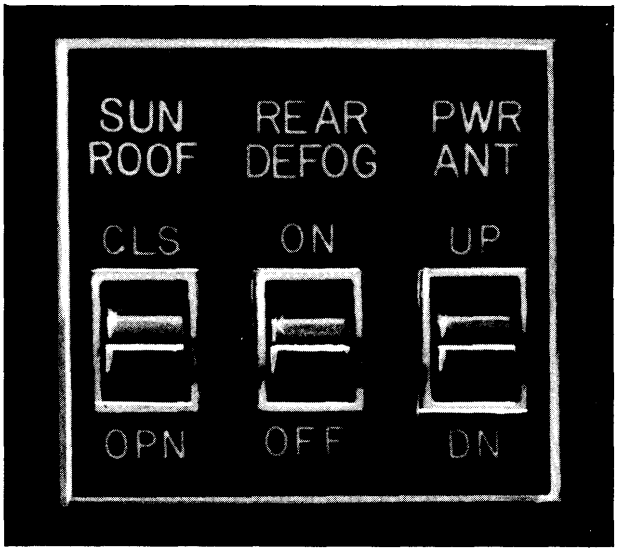


Fig. 15-17 Accessory Switch Panel

1. Remove accessory switch panel as outlined in Section 12, Note 88a.
2. Disconnect switch wiring connector from De-Fogger harness connector, bulb with socket from switch and remove accessory panel with switch attached.
3. Connect self-powered test light across yellow and light green wires. Test light should now be off. Pulsing De-Fogger switch to "ON" position should turn test light on. Remove test light lead from yellow wire and connect it to brown lead, leaving other lead on light green wire. Pulsing switch to "OFF" position should make test light come on.
4. Visually check switch light bulb. If filament of light bulb is intact, reinstall light bulb and socket into switch housing. If light bult does not light or filament is broken, the bulb should be replaced.
5. Install accessory switch panel with De-Fogger switch into instrument panel as outlined in Section 12, Note 88b.

SERVICE INFORMATION

21. De-Fogger Switch Removal and Installation

The procedure for removing and installing the accessory switch panel is described in Section 12, Note 88b. All other service information pertaining to the rear window De-Fogger is covered in the body manual.

22. De-Fogger Relay Removal and Installation

a. Removal

1. Remove lower steering column cover as outlined in Section 12, Note 58a.
2. Disconnect electrical wiring connector from relay.
3. Remove two screws securing relay to upper steering column support and remove relay.

b. Installation

1. Position relay to upper steering column support and secure with two screws.
2. Connect electrical wiring connector to relay.
3. Install steering column lower cover as outlined in Section 12, Note 58b.

BACK TO INDEX

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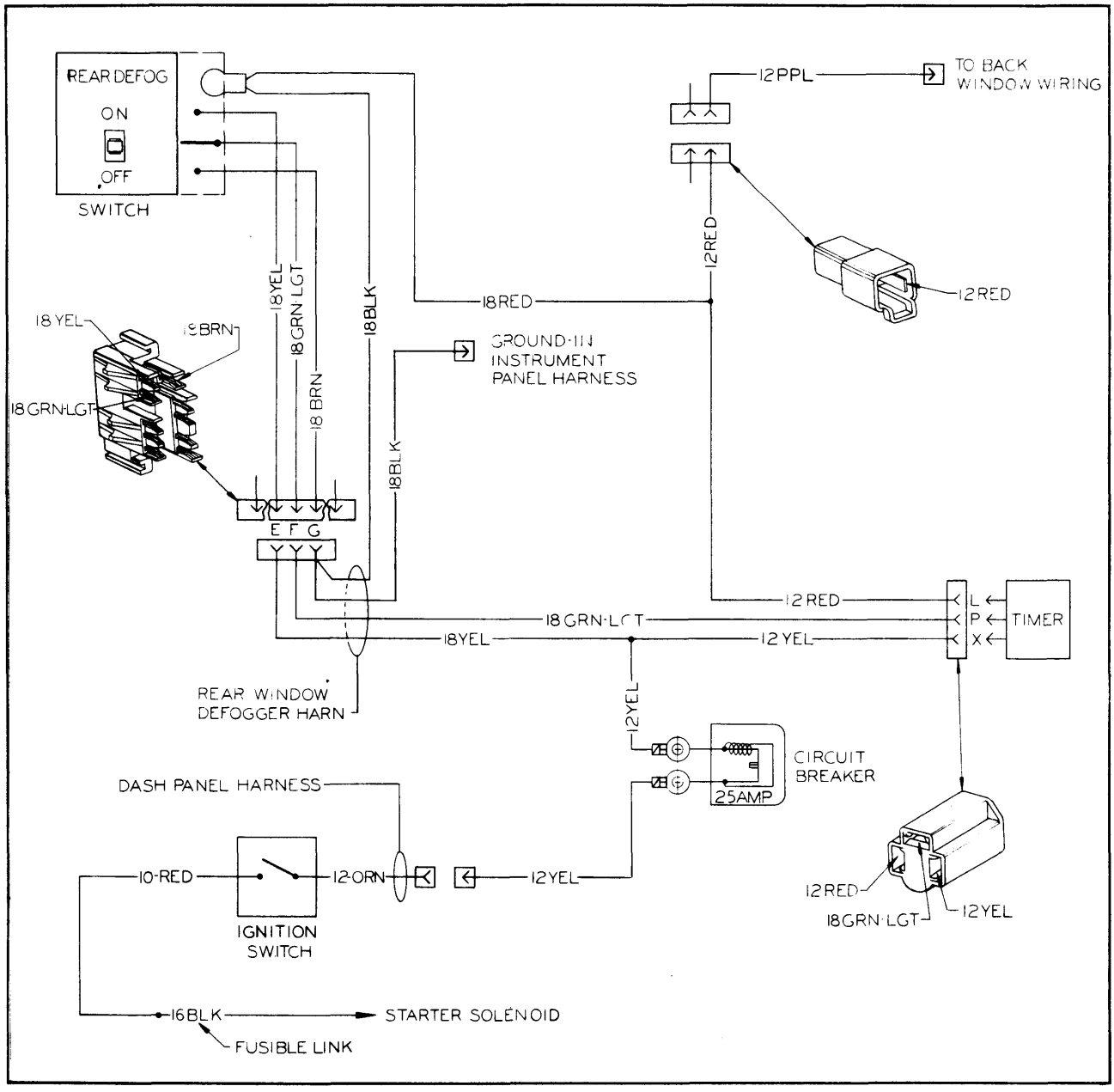


Fig. 15-18 Rear De-Fogger Circuit Diagram

BACK TO INDEX

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CONTROLLED CYCLE WINDSHIELD WIPER AND WASHER SYSTEM

Controlled Cycle Wiper System Mechanical Features

The controlled cycle windshield wiper and washer system consists of a wiper unit which contains a 12-volt motor, a gear box section, a relay control, a pulse timing control, and a washer unit.

The wiper and washer assembly is controlled by a switch (driver control) located on the instrument panel pad to the left of the left hand air conditioning outlet. The wipers can be operated at the usual three different speeds plus a new delay position. The washers are activated by depressing the washer button, integral with the switch. When the washer button is depressed, the wipers operate at low speed, even when in the delay mode. The washer delivers washer fluid to the windshield for approximately six complete wipe sweeps after the button is depressed. After washer fluid delivery stops, the blades continue for two additional wipes to dry the glass, and then stop automatically (unless control switch is "ON").

In the "DELAY" mode, the wipers will stop at a "rest" position at the bottom of the windshield after a delay wipe or after the wash cycle.

Controlled Cycle Wiper System Electrical Operation (Fig. 15-19)

Low Speed - Moving the control lever to the "LO" speed position connects the relay control, the shunt field, and the pulse relay directly to ground. This provides the following circuit:

Current feed to the 25 AMP windshield wiper fuse in the fuse panel comes from the accessory terminal on the ignition switch. Current flows through the yellow wire to terminal number 2 of the wiper motor. It then flows through the tan wire to one contact point on the relay switch. Current also flows through the relay coil and back through the red wire to terminal number 1, and through the light blue wire and the switch to ground. Current through the relay coil causes the relay switch to close to allow current to flow to the motor. After the current passes through the relay switch, it flows through the orange wire, through the pulse relay coil, and through the green wire to terminal six back to ground through the switch. Current through the pulse relay closes the pulse relay switch to allow current to flow through the series field, where it divides; part flowing through the armature, and through the circuit breaker and black wire to ground, the other part flowing through the shunt field, the solid black wire to terminal number three, and on through the black with double orange tracer wire to ground at the control switch. Current by-passes the 20 ohm resistor ground circuit at terminal number 3 at this time because of the lower resistance of the control switch ground circuit.

Medium Speed - Moving the control switch to the "MEDIUM" speed position connects a 13 ohm resistor, located in the control switch, in parallel with the 20 ohm resistor connected between the shunt field circuit and ground. The two resistors connected in parallel provide slightly less than 8 ohms resistance in the shunt field, thus allowing less current to flow in the shunt field than was possible in "LO" speed. This permits correspondingly more current to flow through the armature, resulting in medium speed.

High Speed - Moving the control switch to the "HIGH" speed position eliminates the path from the shunt field to ground in the control switch, leaving only the 20 ohm resistor in the shunt circuit. This one resistor allows even less current to flow through the shunt field than was possible at medium or low speeds, which results in high speed operation.

Delay - Moving the switch to the delay position grounds the relay coil and the shunt field through the control switch as in low speed operation. With the switch in the minimum delay position, the wipers operate identically to low speed operation. However, as the switch is moved to the right, the wipe speed remains the same, but a pause is introduced between wipe cycles. At the maximum delay position, a pause of approximately 10 seconds occurs between each wipe cycle. This is accomplished electrically by the use of a transistor and capacitor in the timing circuit and the variable resistor in the driver control switch. In the delay position, the pulse relay coil must be grounded through the timing circuit, as the ground in the driver control switch is not available as in the case in normal operation. When the transistor "turns on", allowing current to flow to ground through the black wire, the pulse relay switch closes and current can flow through the armature and circuit breaker to ground, causing the motor to operate at low speed. When the motor starts, the holding switch closes and the transistor turns off. At the completion of one wipe, the holding switch opens and the ground path for the pulse relay is broken, causing the pulse relay switch to open and the motor stops. The length of the period of time before the transistor turns on again depends on the value of the variable resistor, which in turn depends on the setting of the driver control. Thus, the delay period can be varied from 0 to 10 seconds with the driver control.

Washer Circuit (Fig. 15-19)

Depressing the washer button on the control switch puts the motor in low speed operation but does not physically move the control lever to the low speed position. When the button is depressed, the relay coil and washer coil are momentarily grounded through the control switch. The pulse relay is also grounded through the control switch. This causes the motor to operate, and the washer ratchet rotates allowing the washer override switch to close. When the washer button is released, the ground for the relay coil through the control switch is lost, but the washer override switch allows the current to flow to ground through the black wire and pulse relay switch. Washer fluid is delivered for approximately six complete sweeps after the button is depressed. Two more wipes are made before the washer ratchet wheel forces the washer override switch to open. This eliminates the path to ground for the wiper relay and causes the contact points to motor and the wipers automatically shut off.

If the washer button is depressed while the switch is in the delay position, the normal wash cycle will take place and then the system will return to delay operation.

BACK TO INDEX

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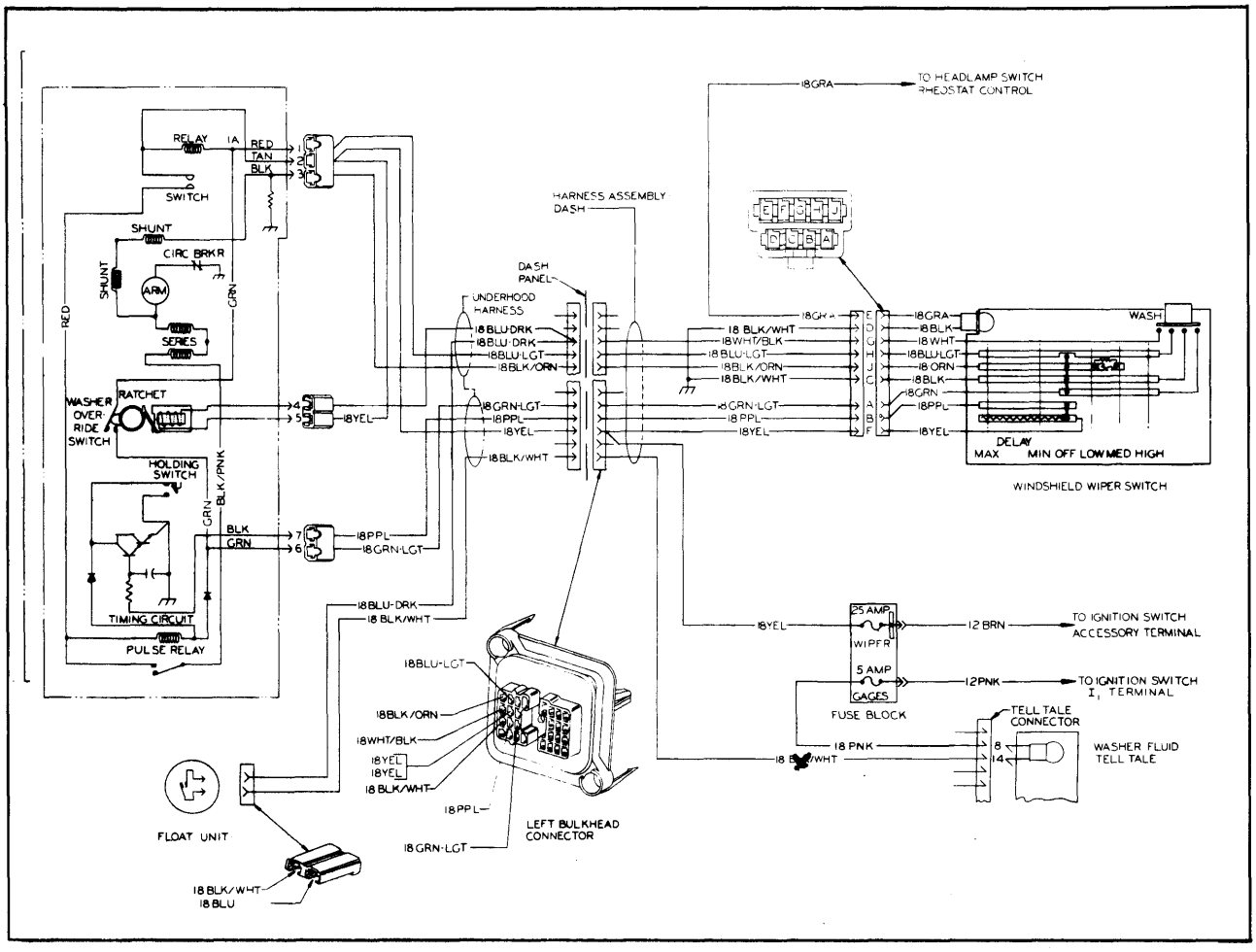


Fig. 15-19 Controlled Cycle Windshield Wiper Circuit Diagram

THEFT DETERRENT SYSTEM

GENERAL DESCRIPTION

The Electronic Theft Deterrent System is designed to provide additional protection for the vehicle, its contents, and trunk and underhood areas, when it has been properly armed.

Alarm Description

The alarm pulsates the vehicle's horns at a rate of 50 cycles per minute, along with the simultaneous flashing of the low beam headlights, parking, tail, license and side marker lamps. In order to conserve vehicle battery power, the alarm shuts off after three to seven minutes of operation and re-arms.

Hood Switch

A plunger-type hood switch is located on the left side of the radiator tie bar in a position where it can sense a small movement of the hood. It is a grounding type switch similar to those used on door lock pillars.

Door and Trunk Locks

The door and trunk locks are equipped with tamper switches. These switches will activate the alarm system if the lock cylinders are tampered with, either by attempting to pull out, push in or rotate the cylinder from its normally installed position.

Fuses

Two in-line fuses are used to protect the system. One 25 amp. fuse is located between the controller and the horn-battery feed and the other, a 20 amp. fuse, between the controller and the external lamps battery feed.

Controller

The solid state controller contains electronic components and power relays. Its operation is two stage, as it must become "Armed" before it can be activated. Attempts to violate the vehicle activate the alarm instantly. The Delco electronics controller can be serviced on an exchange basis with a listening post service center.

BACK TO INDEX

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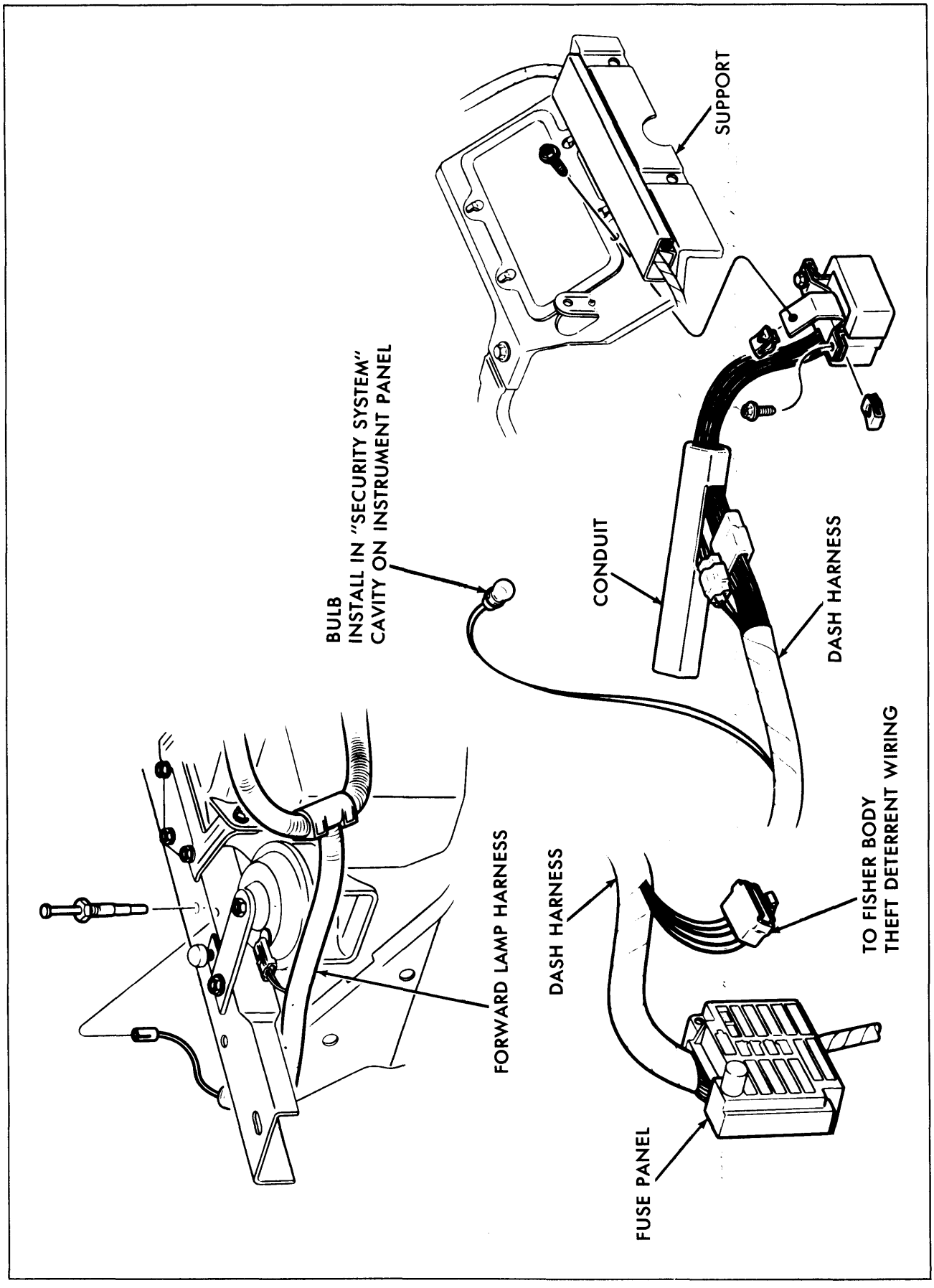


Fig. 15-20 Theft Deterrent Components

BACK TO INDEX

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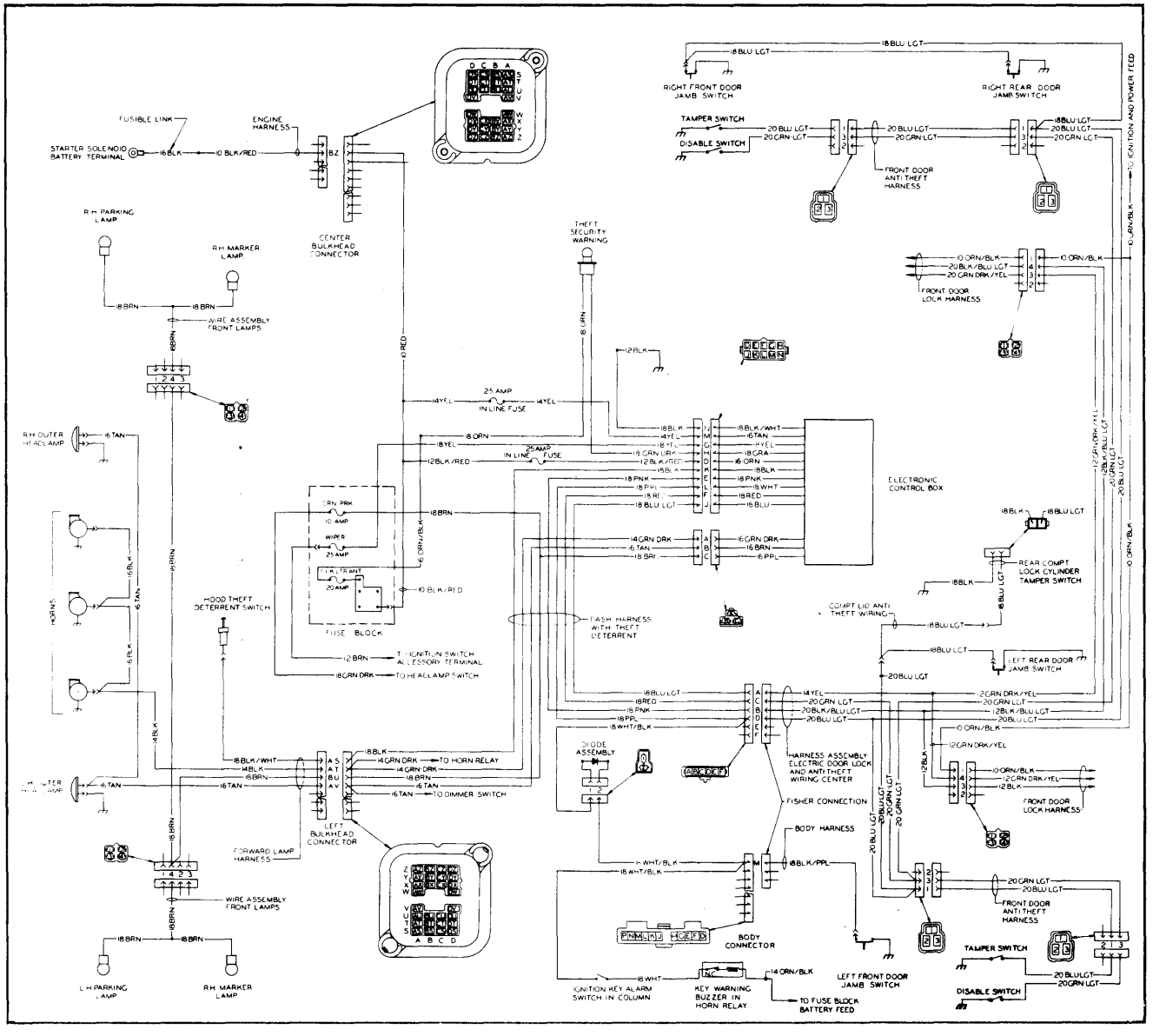


Fig. 15-21 Theft Deterrent Circuit Diagram

BACK TO INDEX

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Location of Parts

As shown in Fig. 15-20, the electronic controller is located beneath the instrument panel center reinforcement support, where it is accessible only after removing the instrument panel pad assembly. The security system indicator lamp is located in the accessory tell-tale lamp panel. The hood sensing switch is installed on the left-hand side of the radiator cradle tie bar in a position inaccessible when the hood is closed or on "Safety". The switch operates as the hood raises to its secondary latch or "Safety" position. The two in-line fuses are located side by side above the radio, one fuse (20 amp.) in the yellow wire and one (25 amp.) in the black with red stripe wire.

Arming

After ignition turn off, the "Security System" lamp in the tell-tale panel will begin flashing when any door is opened. Activating the electric door lock switch to "Lock", causes the security lamp to illuminate steadily. When the last door is closed, the security lamp goes out and the system is armed. With the system armed, the trunk may be entered without setting off the alarm by opening the lock with the key.

Disarming

The system is disarmed by unlocking the door with the key or by turning the ignition on. Alarm shut down is accomplished only by unlocking the door with the key.

If the driver wants to prevent arming the system after using the "Door Lock" rocker switch, the switch can be moved to the unlock position before closing all doors. He may also cancel the arming process by rotating the ignition switch to the "ON" position, then back to lock. Rotating the ignition switch will not cancel the alarm once it is activated.

The doors may be locked mechanically using the manual lock button or door key without arming the system. The door key will disarm and de-activate the system. The ignition key in the ignition lock can only disarm the system, (before the alarm is activated).

Automatic Shut Down

Once the alarm is set-off, it will continue to operate, for a period of approximately 3 to 7 minutes and then shut off to conserve battery power. If the locks have not been damaged, the system will rearm itself.

If a lock has been damaged the "SECURITY SYSTEM" light flashes to alert the driver that the system has activated and the car should be inspected for theft and lock damage. The light does not flash with ignition on, but will continue to flash when the ignition is off.

THEFT DETERRENT DIAGNOSIS CHART

Before using the "THEFT DETERRENT DIAGNOSIS CHART", check the following inter-related electrical components for proper operation:

1. Horns
2. Exterior Lamps
3. Trunk, Door Lock Adjustments
4. Electric door lock circuits

(NOTE: Some system malfunctions DO NOT affect the operation of the tell-tale light. Therefore, a complete testing of proper alarm function is required in order to detect some problems.)

(NOTE: When diagnosing system if instrument panel pad has been removed the 3 wire connector at the controller may be disconnected to eliminate horn and light operation. The relay clicking sound from inside the controller will indicate when system alarm is operating.)

COMPLAINT	PROBABLE CAUSE	CORRECTION
System totally inoperative.	Open in one of the following wires: 1. Ground wire (black) in controller cavity N. 2. Battery feed. 3. Electric door lock wire. 4. Blown fuses. 5. Malfunctioning Controller.	Repair or replace as needed. Same as above. (If fuse in yellow wire is blown, horn only will activate. If fuse in black with red stripe wire is blown, system will not operate.) Replace after investigating previously listed causes.
	Check for loose connectors at controller to instrument panel harness or instrument panel harness to body harness.	Repair or replace as needed.
Inoperative horn and/or headlamps, and/or marker lamps in alarm mode.	Malfunctioning Controller.	Replace after investigating previously listed causes.

BACK TO INDEX

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COMPLAINT	PROBABLE CAUSE	CORRECTION
Unable to reverse arming process with "UNLOCK" switch.	Open in door "UNLOCK" wire circuit.	Inspect circuit from door lock to controller, Fig. 15-21.
	Malfunctioning controller.	Replace after investigating previously listed causes.
"SECURITY SYSTEM" tell-tale light inoperative.	Check "Clk Ltr Ant" fuse. Check bulb. Check wiring to bulb for shorts or open condition.	Repair or replace as needed.
System operates normally except alarm will not activate when hood opened.	Open in hood switch wire.	Repair or replace as needed.
	Inoperative hood switch.	Same as above.
	Malfunctioning controller.	Replace after investigating previously listed causes.
System operates normally except does not disarm at one or both doors.	A. Try to disarm system by opening other door lock with key. If system disarms, check for: 1. Open light green wire to problem door. 2. Malfunctioning door key lock switch. 3. Open ground wire (white) inside door	 Repair or replace as needed. Same as above. Repair as needed.
	B. If system cannot be disarmed from either door: 1. Check for open at 18 red wire at controller with door lock cylinder in unlock position.	 Repair or replace as needed.
	2. Malfunction controller.	Replace after investigating previously listed causes.
Security light will not go out upon closing doors, and system will not arm.	LOCK CYLINDER VIOLATED or unwanted ground at door jamb switches, door and trunk tamper switches or pinched wires leading to these components.	Check for unwanted ground in light blue wire (cavity D) in body to dash harness connector. Repair as necessary.
	Door and trunk lock tamper switches out of adjustment.	Readjust or replace as necessary.
Alarm activates when depressing door lock button when equipped with illuminated lock cylinder option.	Unwanted ground at door jamb switch.	Remove wires from door jamb switch and install wires so that illuminated lock cylinder feed (18 white) is separated from theft deterrent wiring (18 blue).
Alarm activates by itself.	Check for too close adjustment of hood and door jamb switches.	Readjust or replace as necessary.
	Check for corrosion or disconnect a hood jamb switch.	Repair or replace as necessary.
System cannot be armed - tell-tale O.K.	1. Check for ground at #18 red to #18 green wire at body to dash harness connector (cavity C).	Repair or replace as needed.
	2. Courtesy lights do not shut off, also.	Repair grounding condition

BACK TO INDEX

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COMPLAINT	PROBABLE CAUSE	CORRECTION
Drivers door only will not generate alarm.	Open diode in dash harness. (See Fig. 15-21).	Replace diode.
Key buzzer activated by all doors.	Diode shorted.	Replace diode.

SERVICE INFORMATION

23. Controller

a. Removal

1. Unlock door with key.
2. Disconnect negative battery cable.
3. Remove instrument panel pad assembly.
4. Disconnect controller wiring connectors from wiring harness connectors, located just above radio receiver.

(NOTE: Controller is located beneath the instrument panel center reinforcement support.)

5. Remove mounting screw securing controller and mounting bracket to reinforcement support and remove controller.

(NOTE: Repairs can be made to the Delco Electronics controller. If inoperative, it can be exchanged or repaired at a listening post service center.)

b. Installation

1. Position controller and mounting bracket and secure with one screw.
2. Connect controller wiring connectors to wiring harness connectors.
3. Remain in vehicle and lower left front window.
4. Remove ignition key, open door, lock door with electric door lock switch, exit vehicle and close door. Lift manual door locking button and open door. Alarm should activate. To stop alarm, insert key in door lock and turn to "Unlock" position.
5. Install instrument panel pad assembly and connect battery cable.

24. Hood Sensing Switch

a. Removal

1. Open hood.
2. Reach under left hand side of radiator cradle tie bar and disconnect wiring from sensing switch.
3. Remove nut securing switch to tie-bar and remove switch.

b. Installation

1. Position switch through tie bar and secure with nut.
2. Reach under tie bar and connect wiring to switch.
3. Close hood.
4. With door and window open, move electric door lock switch to "Lock" position and close door.
5. Check system by opening hood.

c. Switch Adjustment

(NOTE: Make certain that hood is properly aligned and hood primary and secondary latches are properly adjusted.)

1. Exert upward pressure at left front corner of locked hood.
2. If alarm sounds, remove switch, adjust upward and shim with washer(s) as required.
3. Lower hood and re-arm system. Repeat Steps 1 and 2. Alarm should not sound.
4. Pull hood release cable; alarm should sound. If alarm does not sound, stretch hood pop-up spring to raise hood fully to secondary latch position.

BACK TO INDEX

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FUEL MONITOR SYSTEM
LOW FUEL LEVEL WARNING INDICATOR

The Low Fuel Level Warning Indicator is an optional accessory on all series cars and is mounted in the fuel gage, Fig. 15-22 A red light emitting diode next to the "E" empty mark on the gage will glow when the fuel level in the tank is low. The light glows more brightly as the fuel level drops.

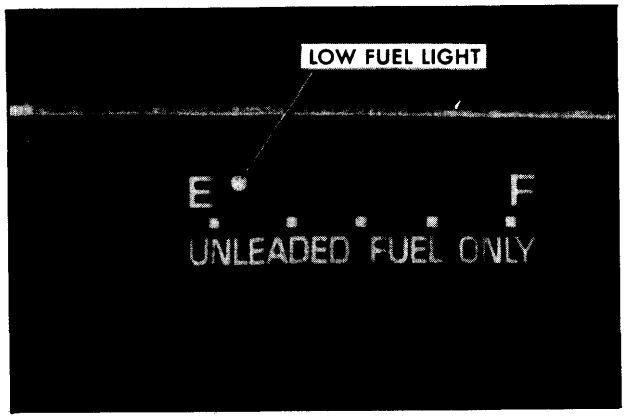


Fig. 15-22 Low Fuel Level Warning Indicator

DIAGNOSIS

Diode Test

This test is designed as an on-car check using a non-powered test light.

1. Turn ignition switch to "On" position.
2. Pull down on fuel filler door and disconnect tan wire connector from body end panel connector, Fig. 15-23.
3. Connect one lead of test light to terminal in end panel connector and other end to rear bumper (ground). Test lamp should light, fuel gage needle should drop to "E" mark and low fuel diode light should glow. If so, system is operating normally. Remove test light, join connectors together and turn ignition off. See Electrical Instrument Diagnosis in Section 12, Note 23, for inoperative fuel tank unit.
4. If test does not operate as described above, re-connect test light for proper ground and retest.
5. If only test light operates without pointer going to "E", fuel gage is inoperative. If pointer goes to "E" and diode does not light, diode or low fuel mylar within gage unit is inoperative. See electrical instruments diagnosis in Section 12, Note 23.

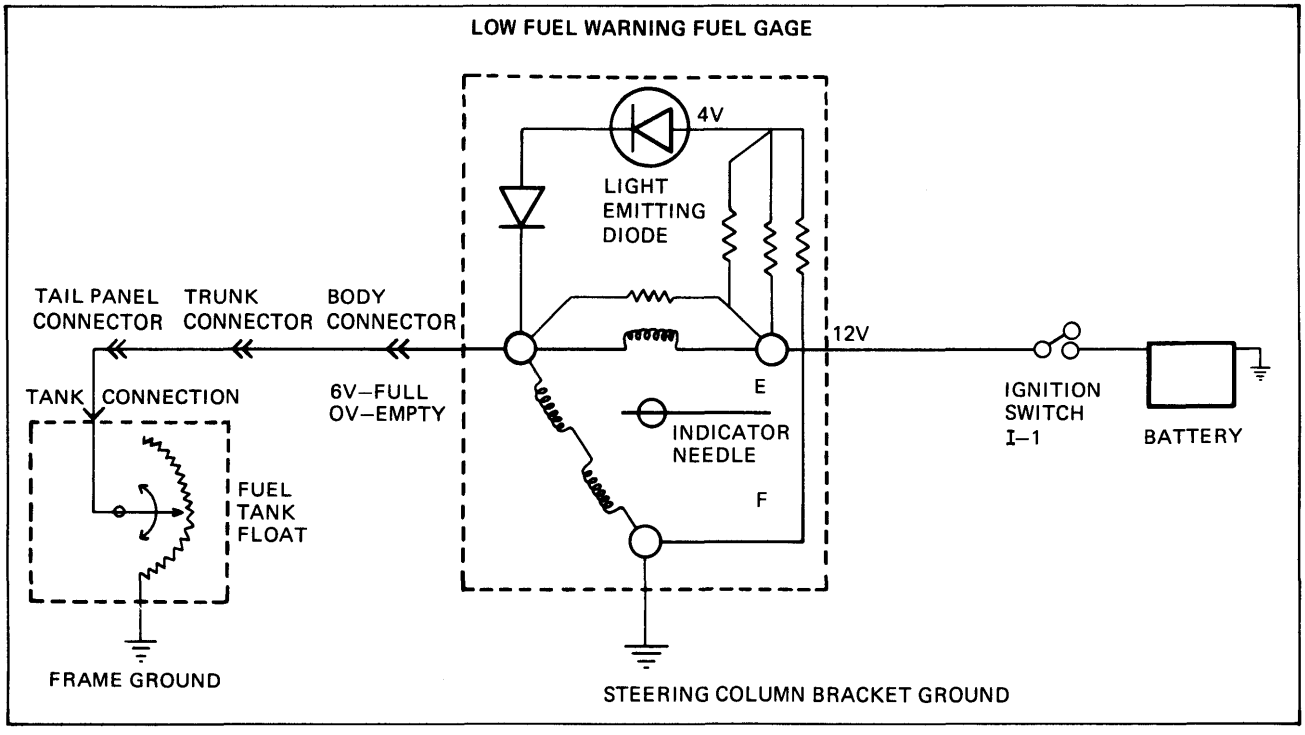


Fig. 15-23 Low Fuel Level Circuit Diagram

BACK TO INDEX

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FUEL ECONOMY INDICATOR SYSTEM

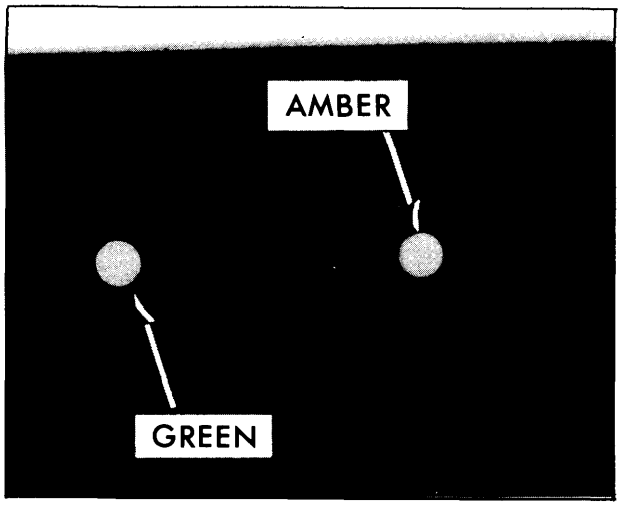


Fig. 15-24 Fuel Economy Indicator Lights

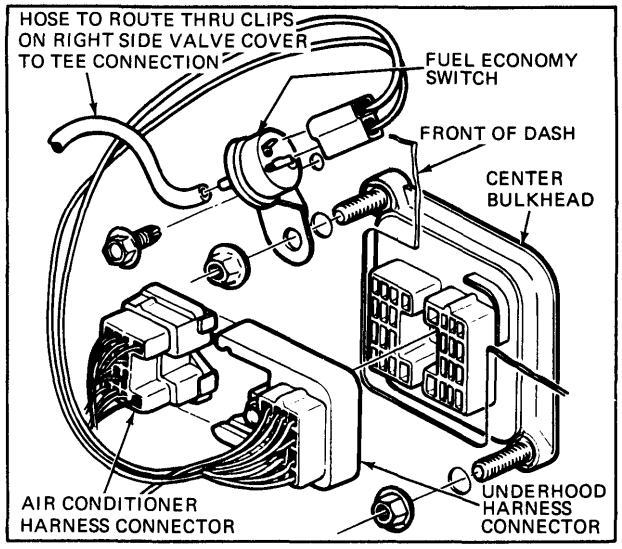


Fig. 15-25 Fuel Economy Indicator Components

The Fuel Economy Indicator System, Fig. 15-24, is an optional accessory using, a green and an amber indicator light in the accessory telltale panel, a fuel economy (vacuum and electrical) switch mounted at the center bulkhead connector Fig. 15-25, and an inter-connecting vacuum hose and tee.

On light throttle acceleration and cruising, the green indicator light glows to denote relatively economical fuel consumption. On heavy acceleration, the amber indicator light glows to denote relatively high consumption of fuel. The amber indicator will also glow when the ignition is turned "On" with the engine stopped.

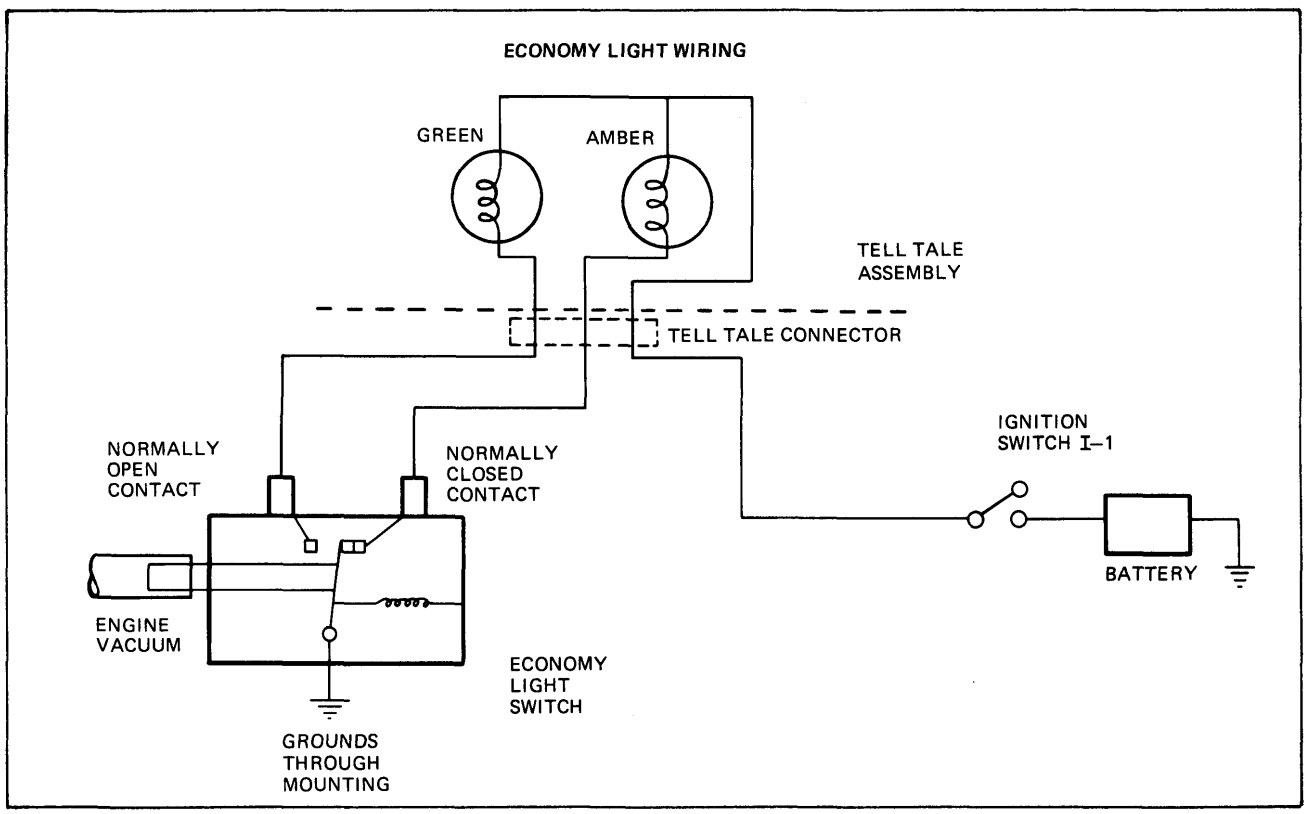


Fig. 15-26 Fuel Economy Indicator System Circuit Diagram

BACK TO INDEX

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A dual contact, manifold vacuum sensing switch lights the proper indicator, to agree with the amount of fuel being used. Both indicators should not light during the transition from one color to another, Fig. 15-26.

DIAGNOSIS

Functional Test

1. Turn ignition switch to "On" position and ground each terminal at economy switch. Both amber and green indicators should glow. If not, check for burned out or missing indicator bulbs.

2. Turn ignition switch to "On" position; amber indicator should glow. If not, check for loose or disconnected wires at fuel economy switch or poor ground. If none of the above correct operation, replace switch.

3. Start engine and allow to idle. Green indicator should glow. If it does not glow, check for a plugged, kinked or leaking vacuum hose between fuel economy switch and vacuum source. Check for loose or disconnected wires at fuel economy switch or poor ground. If none of the above correct operation, replace switch.

4 Tool J-23738 hand operated vacuum pump may be used to check the vacuum switch without running the engine.

SUNROOF

THEORY OF OPERATION

An electrically-operated motor-driven Sunroof, Figs. 15-27 and 15-28 is available as an optional feature on all cars except the limousine and commercial chassis. The Sunroof permits opening of a sliding roof panel to admit sunshine and outside air into the passenger compartment.

Operation

The Sunroof is operated by a two-position switch labeled "SUN ROOF", Fig. 15-28, located in the accessory switch panel. To open roof panel, with ignition ON, the control switch is moved downward toward the letters "OPN". The roof panel then retracts down and rearward, moving on guide rails, Fig. 15-28, from the flush roof position back into a storage space between the headlining and the roof. To close the roof panel, the switch is moved upward, toward the letters "CLS". The panel then moves forward in the guide rails and, as it nears the end of forward travel, the rear portion moves upward on two ramps, Fig. 15-28. This positions the panel flush with the roof and seals it tightly in the opening.

The Sunroof can be left partially open by releasing the control switch at any position in either direction of its travel.

Manual Operation

The Sunroof can be closed manually in the event it should fail to close when the control switch is moved to the "CLS" position. To do this, remove the small round plug located in the center of the headlining near the front edge of the roof opening to gain access to the winding gear. Remove the plug by grasping with fingers and pulling outward, Fig. 15-30. Remove the screw (visible when plug is removed) using hex end of crank handle provided in glove box.

The threaded end of crank handle is screwed into the winding gear, Fig. 15-31. Turn crank handle clockwise to close the roof. Remove the crank handle, install and tighten the screw securely, then replace the round plug.

(NOTE: The crank handle can be used only to close the roof.)

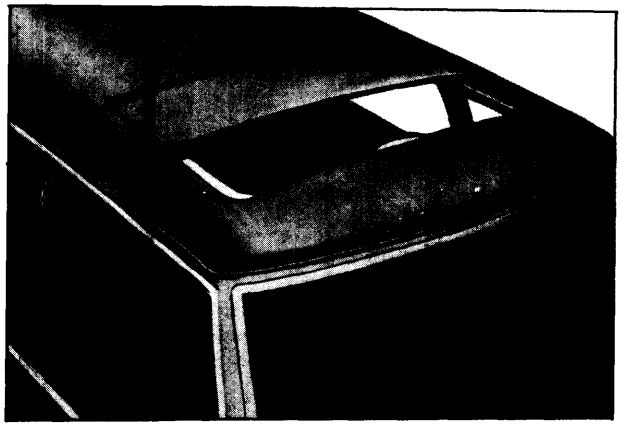


Fig. 15-27 Sunroof Partially Opened

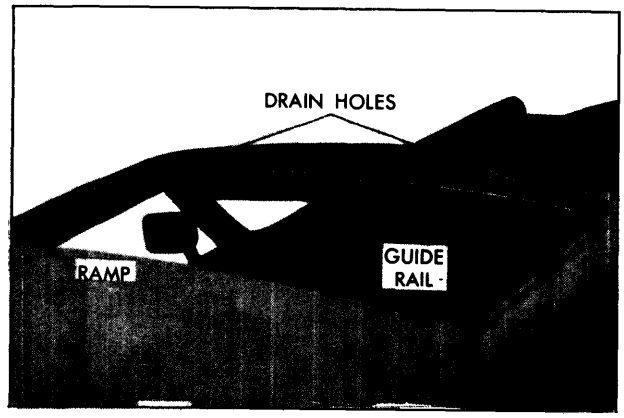


Fig. 15-28 Sunroof Fully Opened

BACK TO INDEX

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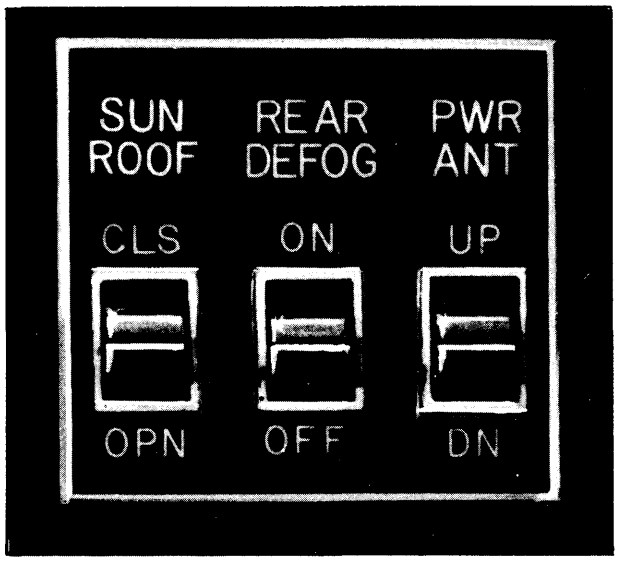


Fig. 15-29 Accessory Switch Panel

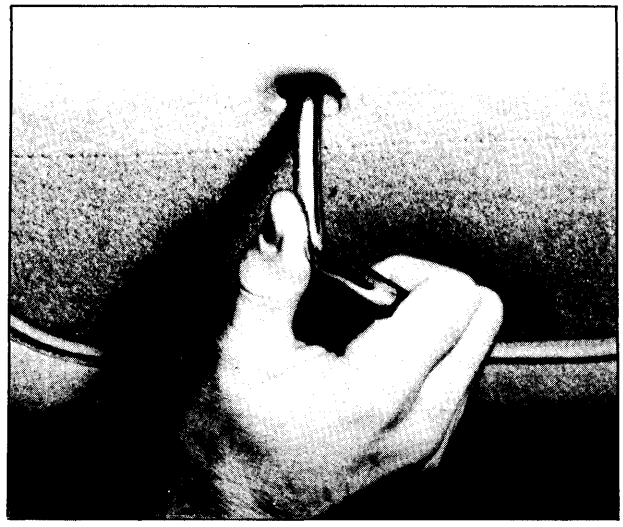


Fig. 15-31 Closing Sunroof with Crank Handle

Design and Construction Features

The Sunroof is actuated by a two-way electric motor mounted near the center of the windshield header area, Fig. 15-32. The motor drives an auxiliary unit with a gear on the output shaft. This gear, in turn, drives two flexible gear cables that are attached to the roof panel and control its movement, Fig. 15-33.

Four plastic drain tubes, two on each side, are incorporated in the windshield pillar area and in the rear quarter area to catch water seepage that may bypass the weatherstrip seal around the roof opening. The two forward tubes, Fig. 15-34, are routed from the roof panel trough down through the right and left windshield pillars, and out through the rocker panels. The rear drain tubes are routed through the rear quarter panel and drain through the rear wheel housings.

Electrical System

The electrical circuit for the sunroof is protected by a 25-amp circuit breaker located on the left hand body bracket at the left end of the lower steering column cover.

Electrical power for the system, Fig. 15-35, is supplied from the fuse block through an orange wire to the 25-amp circuit breaker. Another orange wire is routed from the circuit breaker to a four-way connector that leads to the control switch on the instrument panel. An orange feed wire leads to the switch. Two wires – black for the open cycle and light green for the close cycle – are routed from the switch to the motor.

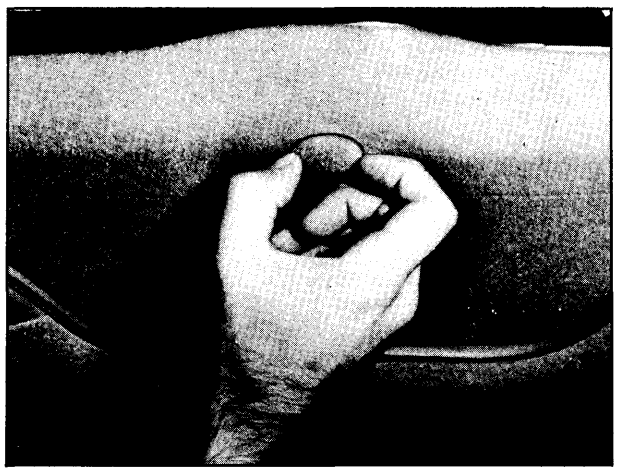


Fig. 15-30 Removing Winding Gear Access Plug

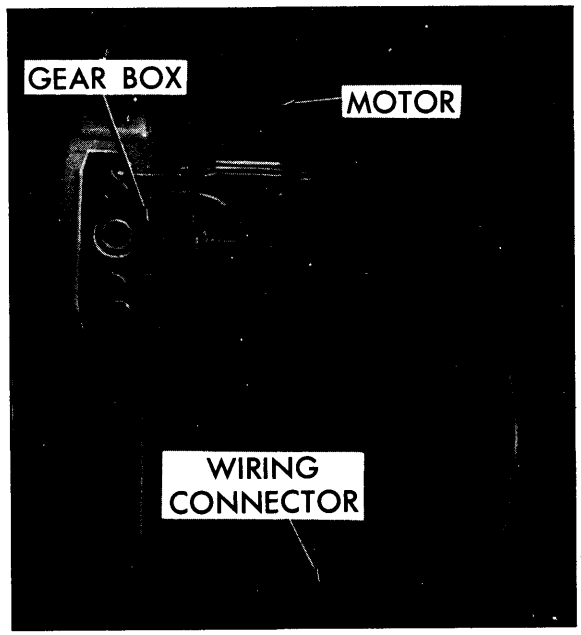


Fig. 15-32 Motor And Drive Unit Location

BACK TO INDEX

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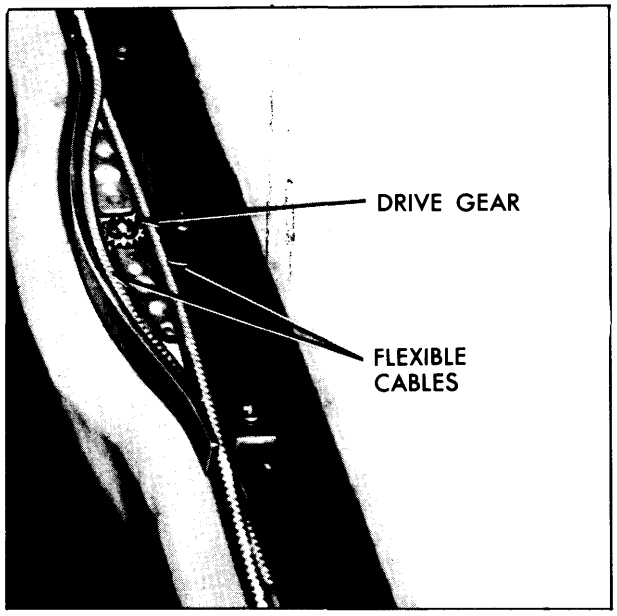


Fig. 15-33 Drive Gear And Cables

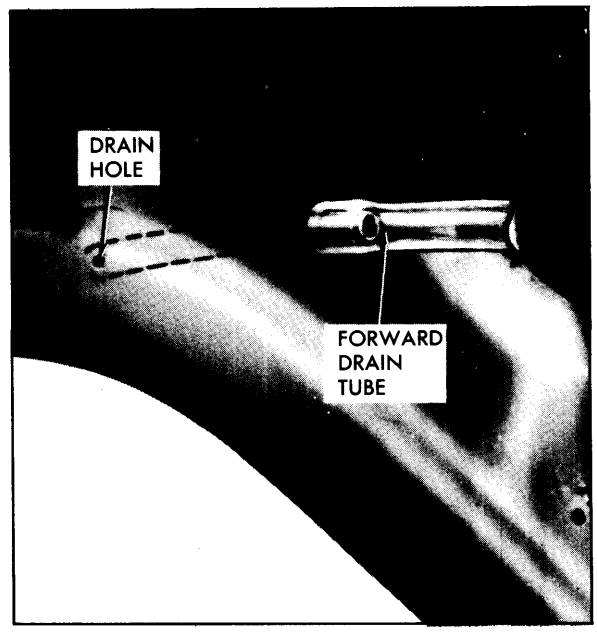


Fig. 15-34 Forward Drain Tube Left Side

DIAGNOSIS

Diagnosis of Inoperative Panel

1. Motor runs, panel does not rise.

a. Panel does not run due to mechanical resistance, see Note 26d, Panel Does Not Run True, and Note 26e, Cable Guide Alignment. Drive cables may be disconnected or broken.

b. Front slides are tilted and require alignment; see Note 26c, Ramp Alignment.

2. Motor Does Not Run (Fig. 15-35).

a. Check continuity of circuit breaker and wiring connector at control switch.

b. Check control switch to assure electrical continuity to motor.

c. Check wiring and connections to motor. Check motor ground wire.

d. Replace motor.

SERVICE INFORMATION

25. Headlining Panel

a. Removal

1. Open roof panel slightly.

2. Unsnap forward portion of headlining panel by gently prying downward. Fig. 15-36.

3. Open roof panel to within three inches of full open position to permit rear of headlining frame to fall clear of roof panel rear hooks.

4. Grasp headlining panel front edge and pull it forward and out of side guide rail lower tracks.

b. Installation

1. Retract roof panel to full open position.

2. Align headlining panel with side guide rail lower tracks and move rearward into proper position.

3. Close roof panel part way, leaving it open approximately three inches.

4. Position headlining snaps to holes in panel and tap into place with heel of hand. Fig. 15-37.

26. Adjustments and Related Repairs

a. Panel Alignment, Front Left or Right

1. To obtain a flush fit with the roof on one side of front of roof panel, loosen both front slide screws, Fig. 15-38.

2. Turn knurled adjuster nut counterclockwise to raise roof panel and clockwise to lower panel, Fig. 15-38.

3. After proper alignment is obtained, tighten screws.

4. Adjust opposite front slide in same manner if required.

BACK TO INDEX

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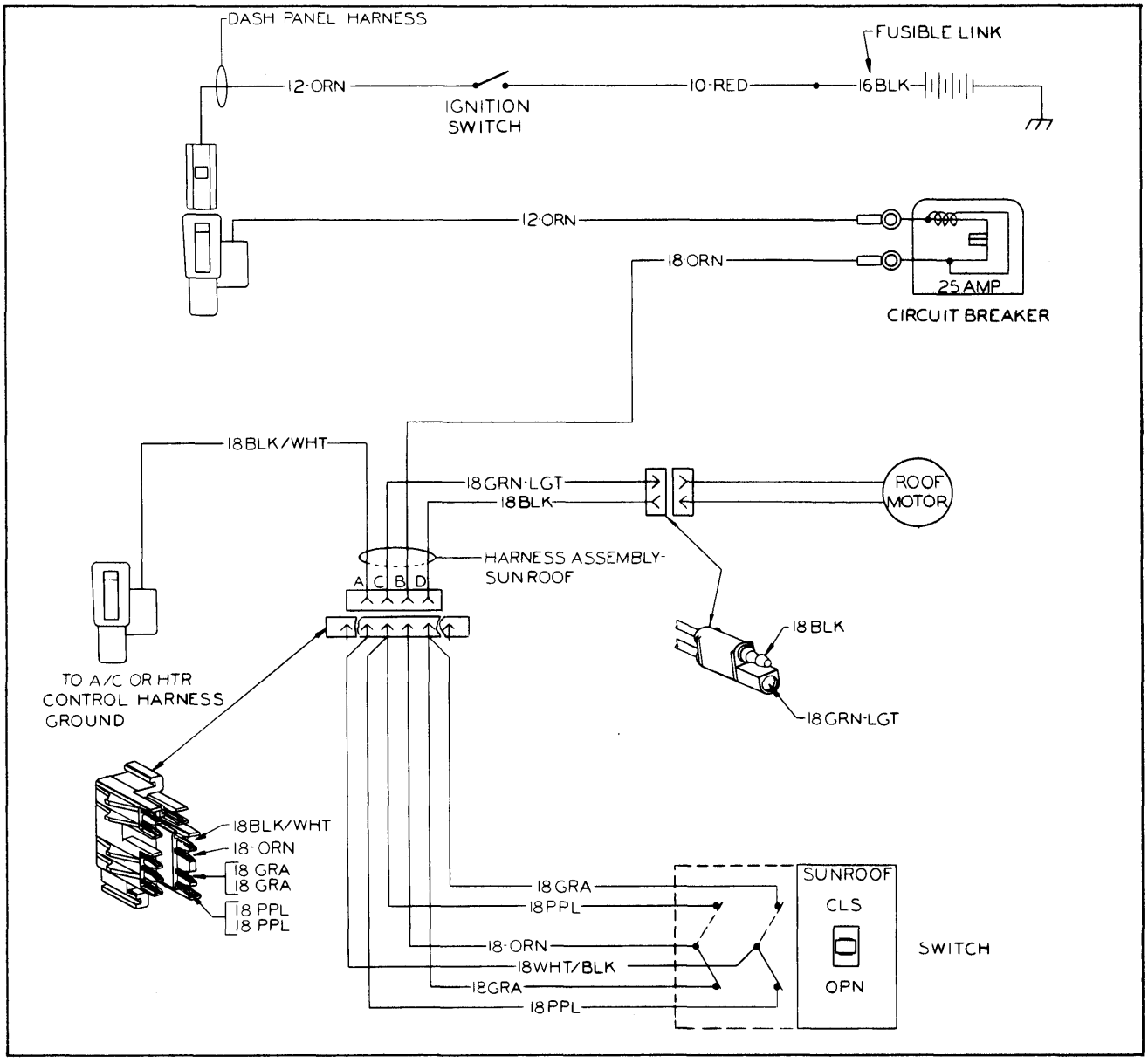


Fig. 15-35 Sunroof Circuit Diagram

BACK TO INDEX

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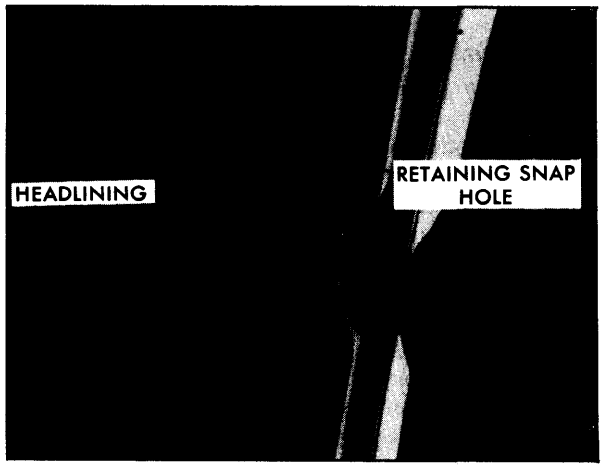


Fig. 15-36 Headlining Panel Removal

b. Panel Alignment, Rear Left or Right

1. To obtain a flush fit with the roof on one side of rear of roof panel, loosen 3/8" locknut on rear slide, Fig. 15-39.
2. Slide pin up or down in channel to obtain proper height and tighten lock nut.
3. After proper alignment is obtained, tighten lock nut.
4. Adjust opposite rear slide in same manner, if required.

c. Ramp Alignment

1. If roof panel does not rise into roof opening during closing cycle, remove headlining panel from roof panel and open roof panel to full rearward position.
2. Examine ramps in drainage channel, Fig. 15-28 to determine if they are properly aligned with lifting elements at rear of panel.

(NOTE: The point where lifting element makes contact with ramp can be seen on rearward slope of ramp, Fig. 15-40.)

3. To adjust ramp, loosen both screws, locate ramp in proper position and tighten screws.
4. Close roof panel and note lifting action of panel.
5. If necessary, readjust ramps until proper lifting of roof panel is obtained.

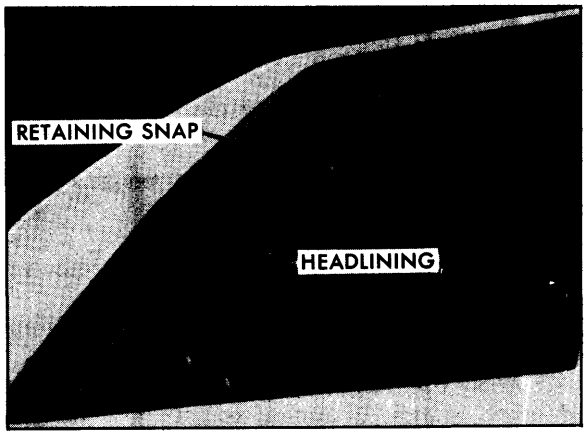


Fig. 15-37 Headlining Snaps

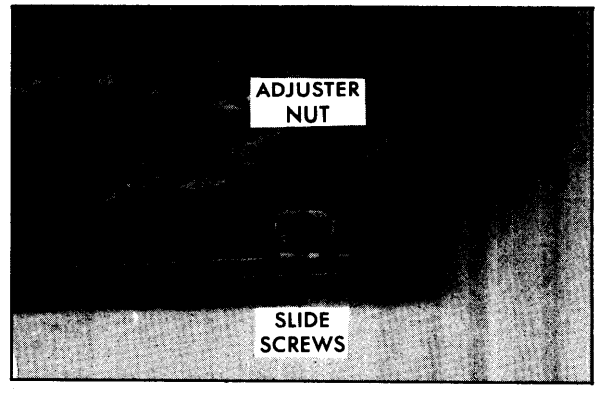


Fig. 15-38 Front Panel Alignment

d. Panel Does Not Run True

1. Close roof panel to determine which side of panel jams.

WARNING: THE CLIP IS MADE OF SPRING STEEL. HOLD HAND OVER CLIP WHEN REMOVING TO PREVENT RAPID SPRING-UP WHEN PERFORMING THIS STEP.

2. Open roof panel, remove drive housing center cover and pry off drive cable retaining clip, Fig. 15-41.
3. To move right hand side of roof panel forward, lift right cable at front of pinion and pull it one or more teeth to the left.
4. Install retaining clip and drive housing cover and check operation.
5. To move left hand side of roof panel forward, perform similar operation on left cable.

(NOTE: Do not move panel while cable is off pinion.)

e. Cable Guide Alignment

1. If roof panel jams during its travel, check both front corner lower elbow guides for alignment with front and side guides.
2. If necessary, shim lower elbow guides to move guides inboard for alignment with adjacent guides.

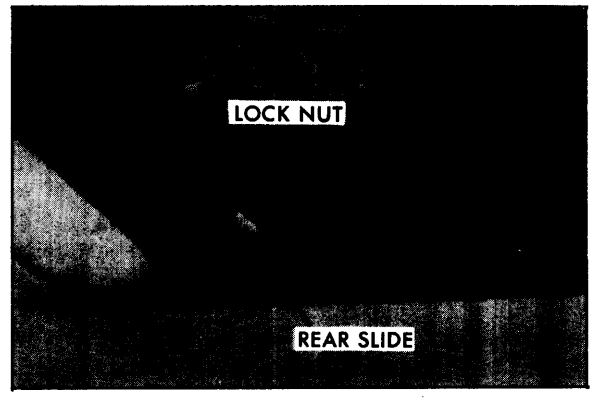


Fig. 15-39 Rear Panel Alignment

BACK TO INDEX

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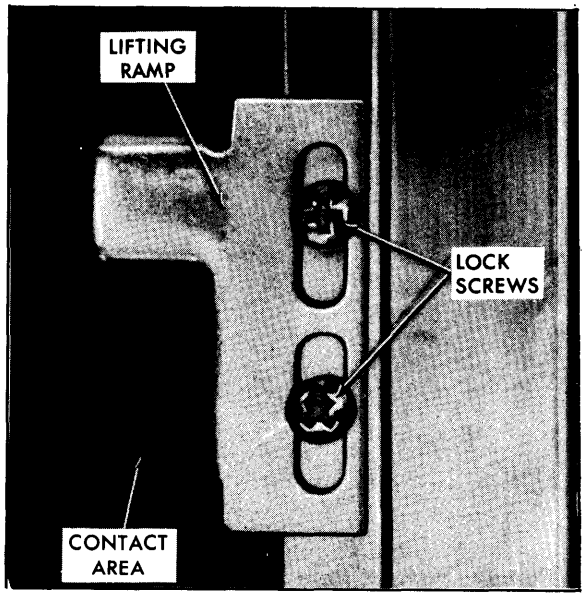


Fig. 40 Lifting Ramp

3. If panel fails to rise, the joints of cable slides are out of alignment (guide rail, corner and connector guides, and cable drive housing) and are jamming cable drive.

a. Loosen screws retaining the guide rails, corner and connector rails, and cable drive housing a few turns.

b. Retighten the screws one by one, continually activating the drive mechanism.

c. Where necessary, realign those points where resistance is felt.

27. Sunroof Switch Removal and Installation

The procedure for removing and installing the accessory switch panel is described in Section 12, Note 88.

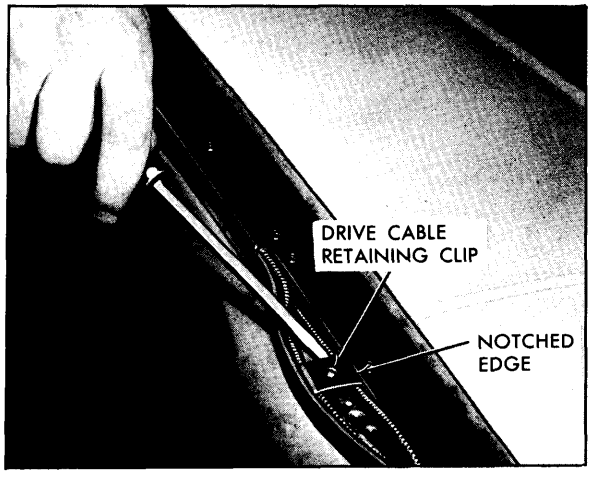


Fig. 15-41 Removing Drive Cable Retaining Clip

28. Motor and Gear Box Assembly

a. Removal

1. Open Sunroof to three-quarter full open position.
2. Disconnect negative battery cable.
3. Remove left and right windshield side garnish moldings, roof side rail garnish moldings, both sun visor assemblies, and center sun visor bracket.
4. Remove left and right windshield upper garnish moldings.
5. Carefully pull headlining from front roof inner panel at top of windshield area sufficiently to gain access to Sunroof motor and gear box assembly, Fig. 15-32.
6. Remove foam insulator padding in front of roof panel opening adjacent to motor and gear box assembly.
7. Disconnect motor electrical wiring connector.
8. Remove drive cable housing cover, Fig. 15-42.
9. Remove left and right elbow corner guides.

WARNING: THE CLIP IS MADE OF SPRING STEEL. HOLD HAND OVER CLIP WHEN REMOVING TO PREVENT RAPID SPRING-UP WHEN PERFORMING THIS STEP.

10. Using a small screwdriver, carefully pry up drive cable retaining clip, Fig. 15-41.
11. Pull drive cables out of upper and lower front guides, observing routing of cables in guides for installation purposes.
12. Remove three screws retaining drive cable housing and remove housing.
13. From top area, remove two gear box assembly retaining screws and remove gear box assembly with motor.

b. Installation

1. Position motor and gear box assembly in drive cable housing.
2. Install two retaining screws.
3. Install drive cable housing with three retaining screws.
4. Insert ends of cables into guides, observing same cable routing as when removed. Lubricate cables and drive gear with #70 grade lubriplate or equivalent.
5. Install right and left elbow corner guides.

(NOTE: Alignment of lower elbow corner guide is of utmost importance.)

6. Install cable retaining clip by pressing down firmly with thumb.
7. Install drive cable housing cover.
8. Connect motor electrical wiring connector and battery cable, and check operation of system.
9. Apply cement to foam insulation padding and install padding.
10. Apply trim cement sparingly to forward edge of roof panel. Starting at center, position headlining to front roof inner panel forward edge. Smooth out all wrinkles, working from center to outboard ends.

BACK TO INDEX

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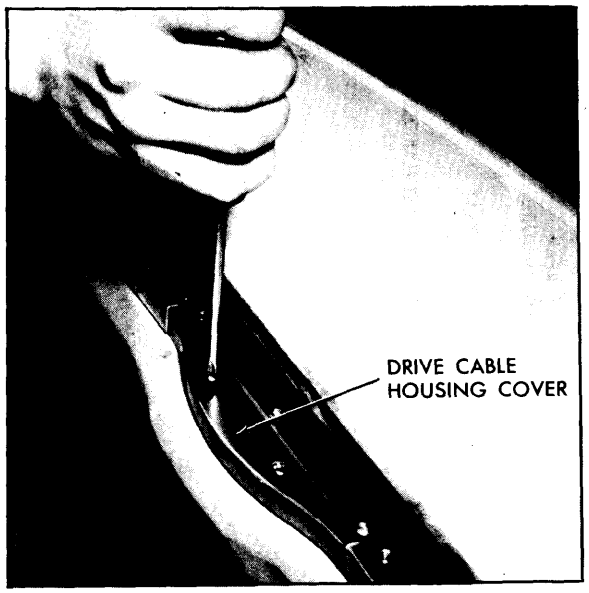


Fig. 15-42 Removing Drive Cable Housing Cover

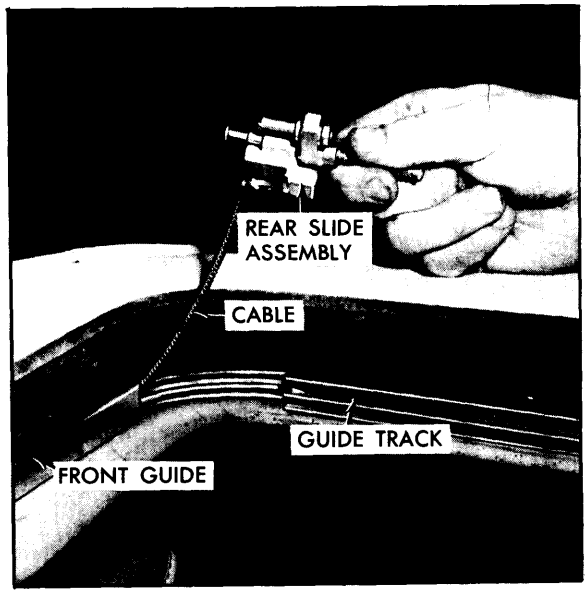


Fig. 15-43 Removing Rear Slide And Cable

11. Install roof side rail garnish moldings, windshield upper and side garnish moldings, center sun visor bracket, and sun visors.

CAUTION: *Be careful not to pinch drain tubes when installing windshield side garnish moldings.*

12. Close Sunroof.

29. Sunroof Panel, Rear Slide, and Cable (Fig. 15-44 and 15-45)

a. Sunroof Panel Removal

1. Open roof panel slightly.
2. Unsnap forward portion of headlining panel by gently prying downward.
3. Open roof panel further to within three inches of full open position, to permit rear of headlining frame to fall clear of roof panel rear hooks.
4. Grasp headlining panel front edge and pull it forward and out of side guide rail lower tracks.
5. Close roof and push headlining panel to full rearward position.
6. Remove outboard screw from each front slide assembly, Fig. 15-46.
7. Loosen inboard slide screw and rotate each front slide assembly inboard to clear guide rail, Fig. 15-47.
8. Pull each rear slide and cable assembly inboard and out of slide retainer hole in roof panel, Fig. 15-48.
9. Lift roof panel at front edge and pull panel forward and out of roof opening.

b. Rear Slide and Cable Removal

(NOTE: If only one cable is malfunctioning, replace both. This assures parallel travel of roof panel.)

1. Remove drive cable housing cover, Fig. 15-42.
2. Remove both front upper elbow guides.

WARNING: THE CLIP IS MADE OF SPRING STEEL. HOLD HAND OVER CLIP WHEN REMOVING TO PREVENT RAPID SPRING-UP WHEN PERFORMING THIS STEP.

3. Using screwdriver, pry off drive cable retaining clip.
4. Pull free end of one cable out of guide rail and drive housing, and pull cable and rear slide assembly forward to front corner, Fig. 15-49.
5. Remove slide from guide track and pull cable out of front guide, Fig. 15-43.
6. Remove opposite cable in same manner.

c. Rear Slide and Cable Installation

1. Position left rear slide in guide track and move slide and cable assembly back until slide is centered with the fifth side guide rail screw from the front, Fig. 15-50.
2. Slide free end of cable into upper front guide, Fig. 15-51, and route cable through the curved front center track in drive cable housing and into lower track on right side. Do not engage cable in drive pinion teeth, Fig. 15-52.
3. Install right slide and cable assembly in same manner as left slide and cable assembly, except that right cable is routed in straight center track in drive cable housing and into lower track on left side, Fig. 15-52.

BACK TO INDEX

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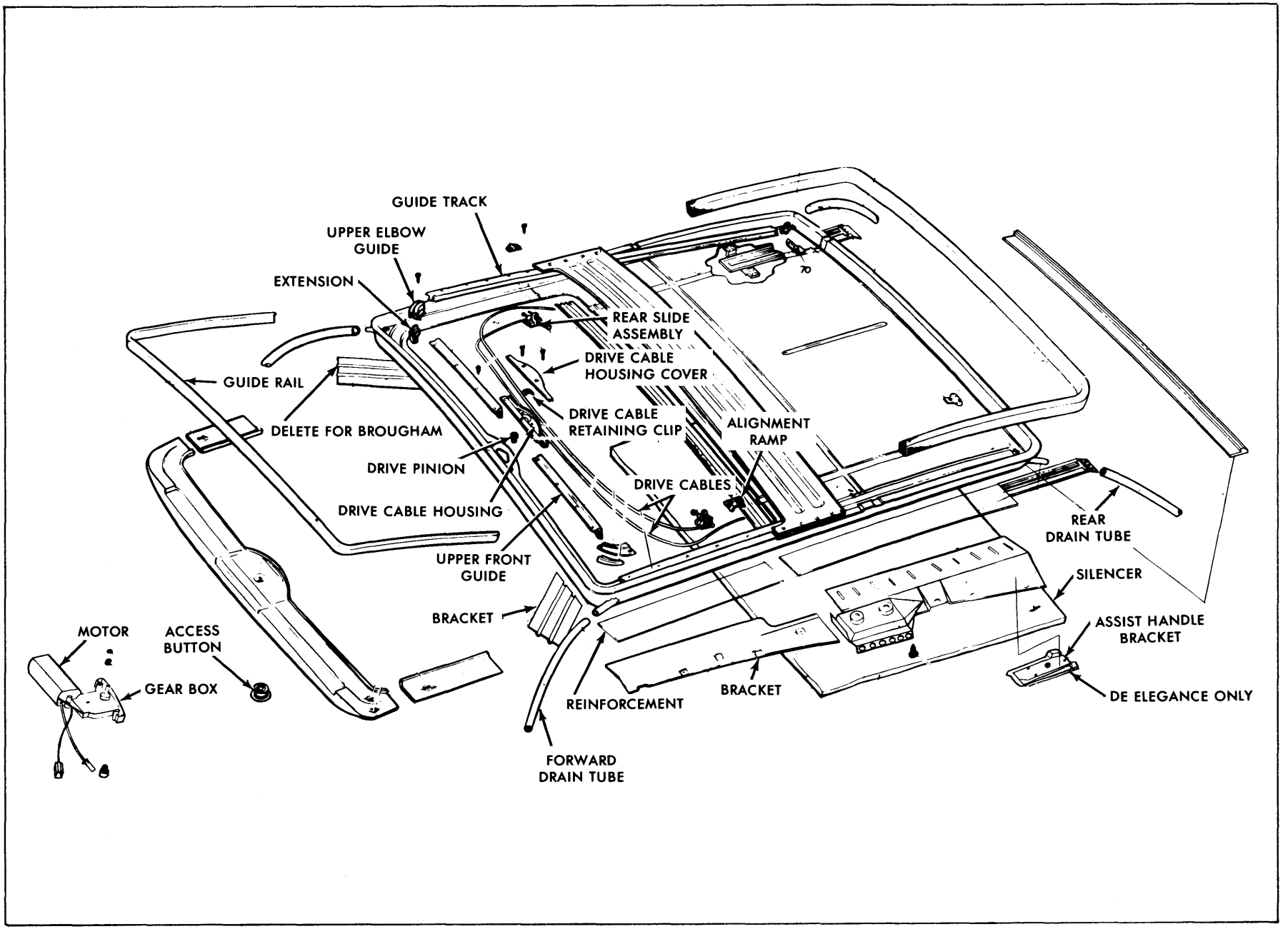


Fig. 15-44 Sunroof Disassembled

BACK TO INDEX

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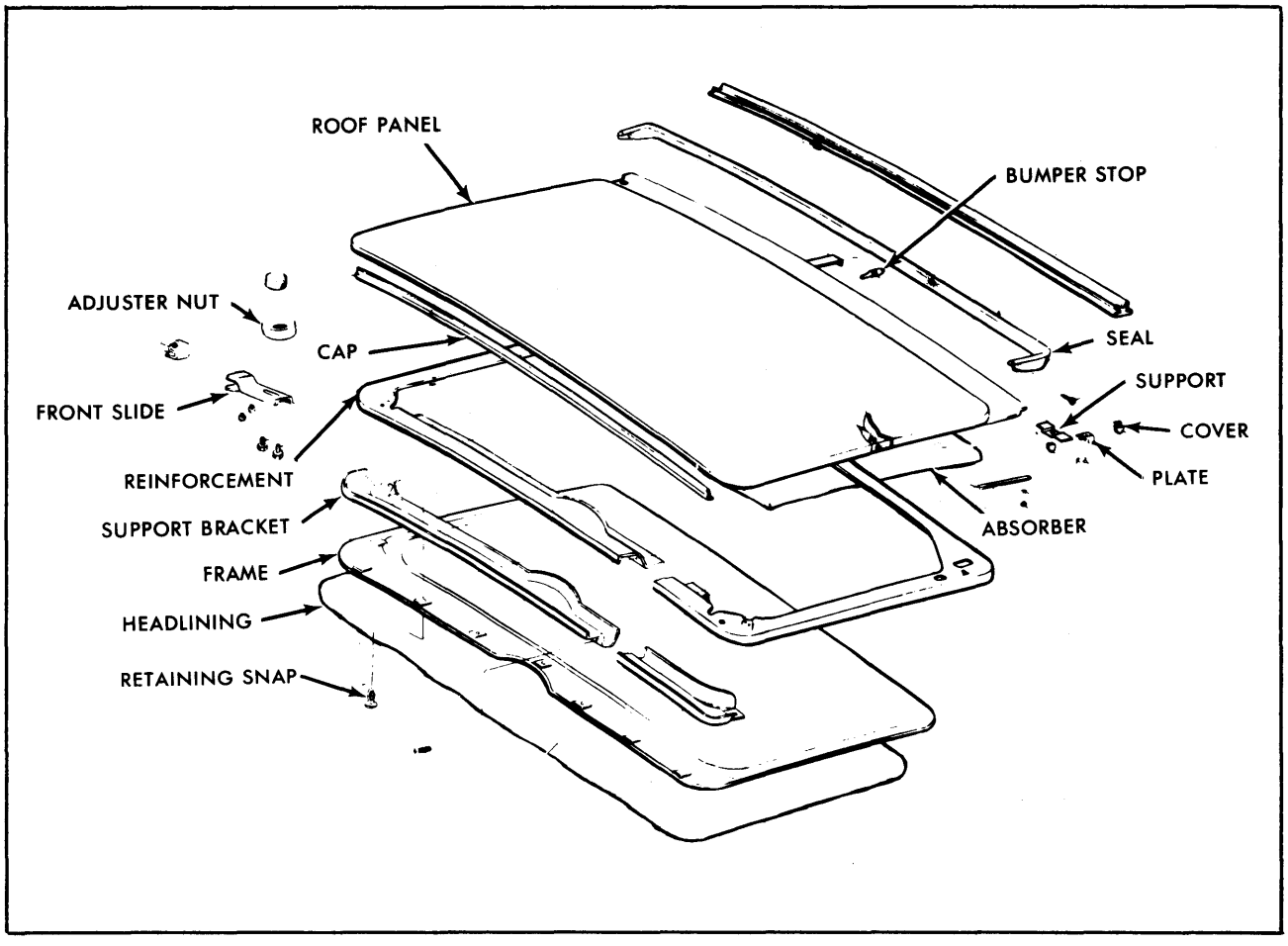


Fig. 15-45 Roof Panel Disassembled



Fig. 15-46 Removing Outboard Screw From Front Slide Assembly



Fig. 15-47 Front Slide Assembly Clear Of Guide Rail

BACK TO INDEX

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Fig. 15-48 Removing Rear Slide And Cable Assembly From Retainer

(NOTE: Make sure right slide is centered with fifth screw from front right guide rail. Do not engage cable in drive pinion teeth.)

4. Check both front corner lower elbow guides for alignment with front and side guides. If necessary, shim lower elbow guide to move guide inboard for alignment with adjacent guides.

5. Lubricate cables at the areas of the elbow guides with #70 grade lubriplate or equivalent and install both front corner upper elbow guides.

6. Recheck rear slides for center position with fifth screw from front on side guide rails, Fig. 15-50. With slides in this position, engage cables in drive pinion teeth.

CAUTION: *This operation is critical to assure roof panel alignment and prevent cable breakage.*

7. Lubricate cables and drive pinion teeth with #70 grade lubriplate or equivalent and install drive cable retaining clip.

8. Install drive cable housing cover, being careful not to overtighten screws.

9. Actuate switch to check cable operation, then return rear slides to fifth screw from front on side guide rails.

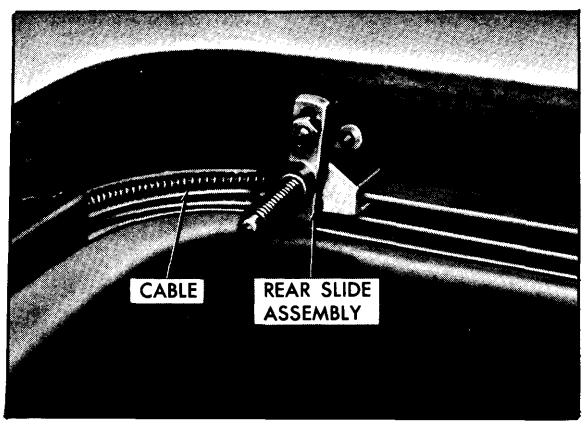


Fig. 15-49 Cable And Slide Assembly Pulled Forward



Fig. 15-50 Rear Slide In Centered Position

d. Roof Panel Installation

1. With headlining panel in full rearward position, install roof panel into roof opening.

CAUTION: *Hold roof panel in a nearly horizontal position when placing panel into roof opening to assure that stop on center rear edge of roof panel does not damage passenger compartment headlining.*

2. Move each front slide assembly outboard and install slides on guide rail upper tracks.

3. Install outboard screws and tighten both screws on each slide, Fig. 15-38.

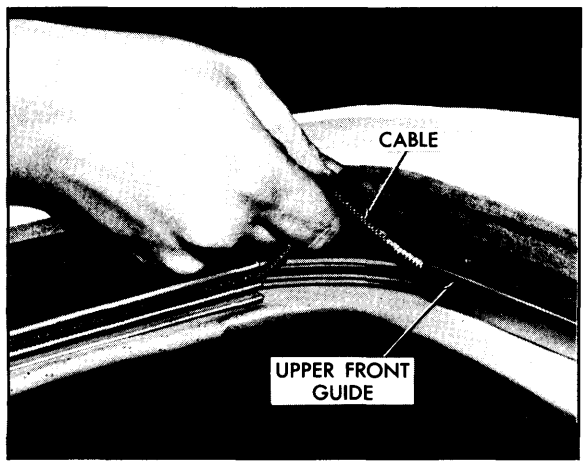


Fig. 15-51 Installing Cable Into Upper Front Guide

BACK TO INDEX

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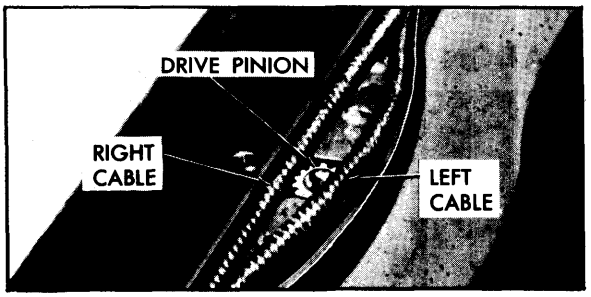


Fig. 15-52 Drive Cables Installed

4. Push roof panel to full forward position by hand.
5. Lift rear of roof panel upward and actuate control switch to position rear slides into alignment with holes on slide retainers on roof panel, Fig. Fig. 15-48.
6. Engage each rear slide pin into retainer hole and install retainer spring plate on slide pin.
7. Actuate switch, check operation of roof panel, and note fit of panel to roof. If any adjustments are necessary, refer to Note 26.
8. Install headlining on roof panel.

30. Drain Hose Replacement

a. Front Drain Hose

1. Perform Steps 3, 4, and 5, in Note 28a, and carefully pull headlining away from top of windshield area sufficiently to gain access to either front drain hose, Fig. 15-34.
2. Remove kick pad trim panel.
3. Remove hose from drain tube outlet at top.

(NOTE: Adhesive is used to secure hose to outlet.)

4. Using a piece of flexible wire or cord, attach new hose to lower end of old hose and pull new hose into position while removing old hose.
5. Secure new hose to drain tube outlet with weatherstrip adhesive.
6. Install headlining, garnish moldings, sun visors, and bracket as described in Note 28b, Steps 11 and 12.

b. Rear Drain Hose

1. Pull down headlining at rear corner to gain access to hose.
2. Remove hose from drain tube outlet at top.
3. Using a piece of flexible wire or cord, attach new hose to lower end of old hose and pull new hose into position while removing old hose.

31. Weatherstrip Replacement

a. Removal

1. With Sunroof panel closed, mark joint of roof opening weatherstrip rear edge and roof panel weatherstrip front edge on both the roof panel and roof at both sides of vehicle.
2. Remove roof panel assembly from vehicle, as described in Note 29a.
3. Remove weatherstrips from roof panel opening and from rear edge of roof panel.

b. Installation

1. Clean surfaces using a suitable cement solvent.
2. Apply weatherstrip cement to both surfaces.
3. Position roof opening weatherstrip slightly below flush of roof and align one end of weatherstrip with mark on roof assembly. Cement weatherstrip to roof opening.
4. Install weatherstrip on rear edge of roof panel in same manner as roof opening weatherstrip described in Step 3.

(NOTE: Roof panel weatherstrip is also retained with trim nails.)

5. Install roof panel assembly into roof opening, as described in Note 29a.

32. Periodic Maintenance

a. Lubrication

1. During cable replacement, lubricate cables with #70 grade lubriplate or equivalent.
2. Periodically clean off any dirt that may have accumulated on guide rail covers.

CAUTION: *Do not lubricate top surface of guide rail covers as this will cause streaks on headlining material.*

b. Drain Tubes

1. During regular maintenance, check the two drain holes at the front corners of the roof panel, Fig.15-28, to make certain they are open and free of foreign material. If drains are plugged, they can be cleaned with an air hose or flexible wire. If they cannot be cleaned in this manner, they must be replaced.
2. To clean rear drain tubes, use an air hose or flexible wire from the bottom of the tubes.

BACK TO INDEX
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ASTROROOF

GENERAL INFORMATION

The Astroroof, Fig. 15-53, consists of a specially treated safety glass panel that allows skylight to enter the passenger compartment. It is equipped with a sliding sunshade that can be closed to block out light. The sunshade is moved by pulling or pushing the handle to obtain the desired settings. To completely close the shade, push its forward edge into the groove at the front of the roof.

The Astroroof incorporates an electrically operated sliding panel that can be opened to admit outside air and light. The sliding panel is operated by a switch in the instrument panel.



Fig. 15-53 Astroroof

DIAGNOSIS

Water Leaks

A water leak occuring in the area of the halo molding is usually caused by an inadequate seal between the Astro roof glass and the metal frame. The metal frame and glass are hermetically sealed. To correct a leak between the metal frame and the glass, remove the roof panel from the car. Use a clear auto glass silicone sealer and apply a bead around the edge of the metal frame.

(NOTE: Do not attempt to pry the metal frame away from the glass to apply the sealer, as this could result in glass breakage.)

SERVICE INFORMATION

(NOTE: For additional service information, refer to the sunroof section.)

33. Halo Molding

(NOTE: To perform adjustments or repairs on an Astroroof, it is necessary to remove the halo molding.)

a. Removal

1. Slide sunshade all the way open.
2. Open roof to halfway position.
3. Remove three screws from front of halo molding.
4. Close roof to within three inches of the fully closed position.
5. Pull the forward center portion of the halo molding downward so the horizontal tabs at the front of the molding are removed from the track.
6. Close roof and slide halo molding forward, pulling downward on the rear center section of the molding to disengage the horizontal slide surface from the track assembly, and remove halo molding.

b. Installation

1. Position rear slide surface of the halo molding into the track assembly pulling downward on the rear center section of the molding to engage the slide surfaces into the track.
2. Slide halo molding to the rear and open the roof panel about halfway.
3. Pull the forward center portion of the molding downward so the horizontal tabs at the front of the molding can be installed into the track.
4. Position halo molding and secure with three attaching screws.
5. Close roof.

34. Sunshade

a. Removal

1. Remove the halo molding as outlined Note 33a.
2. Open roof to full open position.
3. From outside of the car, deflect the sunshade upward in the center to disengage from the track and slide the sunshade forward and out of the car.

b. Installation

1. From outside of the car, deflect the sunshade upward in the center and engage rear corners into the track.
2. Move the sunshade to the full open position.
3. Close roof panel.
4. Install halo molding as outlined in Note 33b.

BACK TO INDEX

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AUTOMATIC DOOR LOCKS
THEORY OF OPERATION

Description

Automatic door locks are an optional convenience item available on all cars. The system is in addition to and operates in conjunction with the electric door locks which are a standard feature on all cars.

All doors will automatically lock after the following:

1. Driver is seated.
2. All doors are closed.
3. Ignition switch "ON".
4. Transmission selector in "drive".

If a passenger(s) exits while the driver remains seated and the transmission selector is in "drive", any and all doors that are opened will relock automatically when all doors are again closed.

To unlock a door(s) with the driver seated and the transmission selector in "drive", the doors must be unlocked either with the electric door lock switch or the manual door lock button. However, with the transmission selector in "park", "reverse", or "neutral" either door on coupes or either front door on sedans may be opened from the inside by merely actuating that inside door handle.

The "driver must be seated" provision avoids the possibility of the driver being inadvertently locked out of the car. The electric door lock switch must be used after parking to lock all doors.

To enter, a standard key is used to unlock either the left or right (front) door. All other doors remain locked until unlocked either with the electric door lock switch or the manual lock button.

Component Parts

Back-Up Light Switch (Fig. 15-54)

A specific back-up light switch is used when automatic door locks are ordered. The terminals on the right are to a switch normally open in "park", "reverse", and "neutral". In "drive" or "lo" the switch contacts close and compete a circuit to the logic module which actuates the electric door lock solenoids (provided that the driver's seat is occupied).

Driver's Seat Sensor

The driver's seat sensor is a normally open switch as used on seat belt interlock cars. Weight of the driver closes the switch and completes a circuit to ground from the logic module.

Logic Module

The logic module is located on the cowl near the left side below the body cross car conduit. Electrical power to the logic module is supplied through the courtesy light circuit.

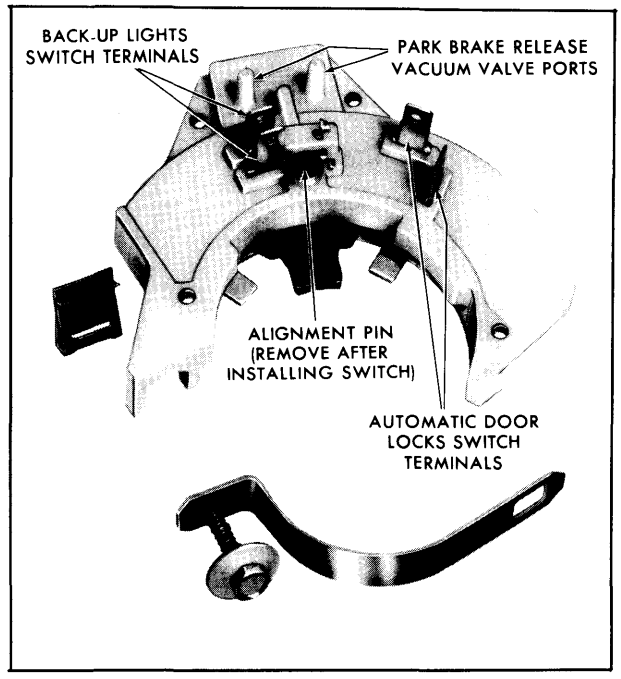


Fig. 15-54 Back-Up Lamp Switch

(NOTE: The logic module circuit board is serviced separately. To avoid shorting the module when replacing the board, remove the 20 amp "body" fuse before servicing.)

Unlock Relay

Two unlock relays are used. Both are taped to the logic module.

Lock Relay

The lock relay is mounted above the left hand kick panel near the body accessory wiring junction block. The wire near the lock relay attached to the shroud behind the kickpad is the ground wire for the logic module.

Door Handle Switches

Front door inside handles each contain a normally open switch. When the handle is actuated the switch closes completing a circuit to the logic module.

DIAGNOSIS AND SERVICE INFORMATION

Back-up lamp switch removal, installation and adjustment is described in Section 12, Note 35.

A complete automatic door lock wiring circuit diagram is provided in Fig. 15-55.

Complete diagnosis procedures and service information is provided in the 1976 Body Service Manual.

BACK TO INDEX

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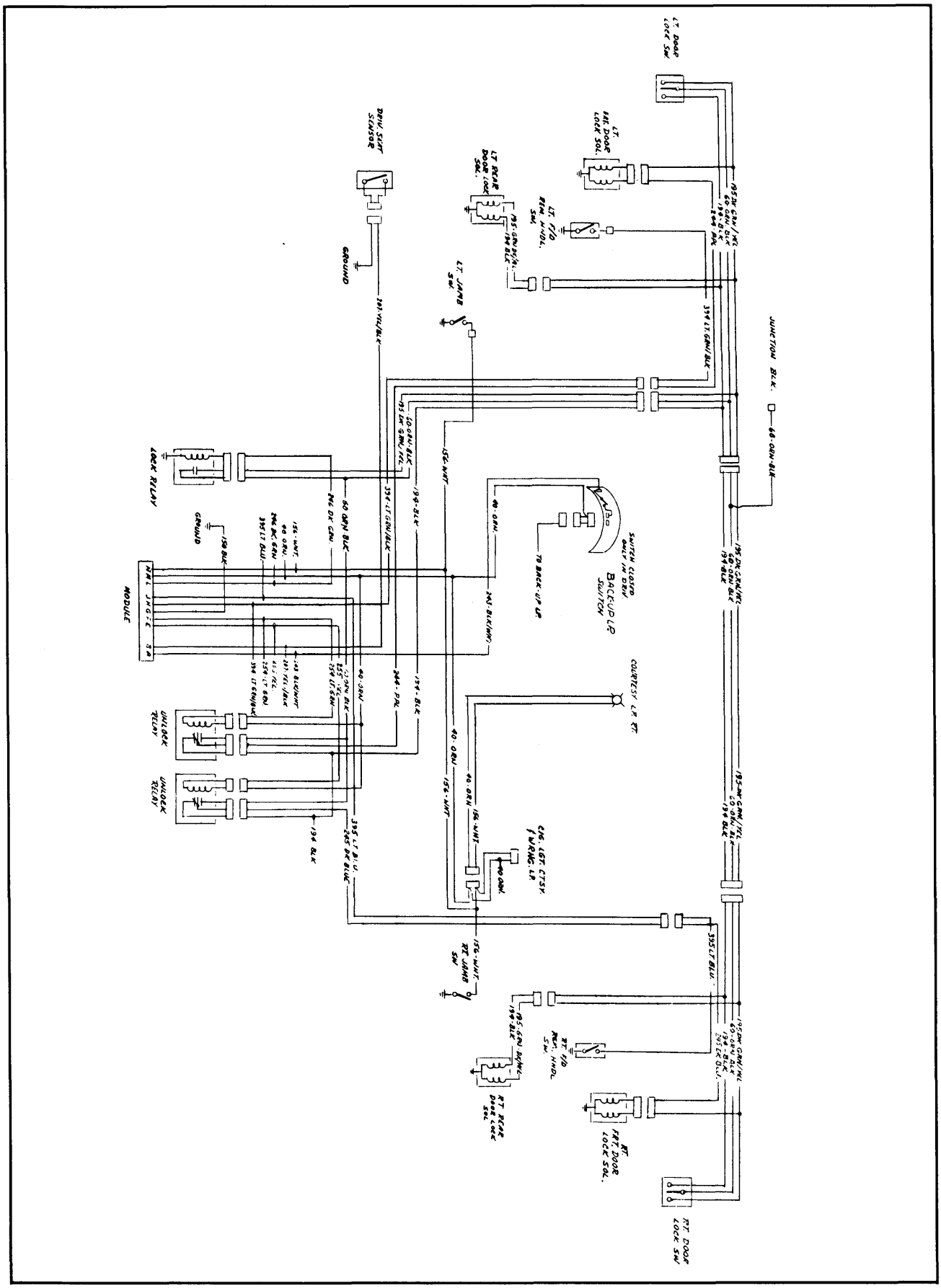


Fig. 15-55 Automatic Door Locks Wiring Circuit Diagram

BACK TO INDEX

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BOLT AND NUT IDENTIFICATION

BOLT STEEL CLASSIFICATION

G. M. MATERIAL NO.	HEAD MARKING	STRENGTH
260-M	 (None)	Standard
280-M	 (120°)	Medium
300-M	 (60°)	High

HEX-NUT STEEL CLASSIFICATION

G. M. MATERIAL NO.	MARKING	STRENGTH
Conventional Type		
286-M	  (None)	Standard
301-M	  USUAL (120°)	High
	  OPTIONAL (120°)	
Prevailing Lock Type (Stover)		
A	 (None)	Standard
B	 (120°)	Medium
C	 (60°)	High

BACK TO INDEX

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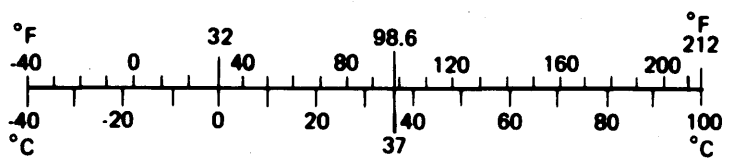
DRILL SIZES

Letter Sizes	Drill Diam. Inches	Wire Gage Sizes	Drill Diam. Inches	Wire Gage Sizes	Drill Diam. Inches	Wire Gage Sizes	Drill Diam. Inches
Z	0.413	1	0.2280	28	0.1405	55	0.0520
Y	0.404	2	0.2210	29	0.1360	56	0.0465
X	0.397	3	0.2130	30	0.1285	57	0.0430
W	0.386	4	0.2090	31	0.1200	58	0.0420
V	0.377	5	0.2055	32	0.1160	59	0.0410
U	0.368	6	0.2040	33	0.1130	60	0.0400
T	0.358	7	0.2010	34	0.1110	61	0.0390
S	0.348	8	0.1990	35	0.1100	62	0.0380
R	0.339	9	0.1960	36	0.1065	63	0.0370
Q	0.332	10	0.1935	37	0.1040	64	0.0360
P	0.323	11	0.1910	38	0.1015	65	0.0350
O	0.316	12	0.1890	39	0.0995	66	0.0330
N	0.302	13	0.1850	40	0.0980	67	0.0320
M	0.295	14	0.1820	41	0.0960	68	0.0310
L	0.290	15	0.1800	42	0.0935	69	0.0292
K	0.281	16	0.1770	43	0.0890	70	0.0280
J	0.277	17	0.1730	44	0.0860	71	0.0260
I	0.272	18	0.1695	45	0.0820	72	0.0250
H	0.266	19	0.1660	46	0.0810	73	0.0240
G	0.261	20	0.1610	47	0.0785	74	0.0225
F	0.257	21	0.1590	48	0.0760	75	0.0210
E	0.250	22	0.1570	49	0.0730	76	0.0200
D	0.246	23	0.1540	50	0.0700	77	0.0180
C	0.242	24	0.1520	51	0.0670	78	0.0160
B	0.238	25	0.1495	52	0.0635	79	0.0145
A	0.234	26	0.1470	53	0.0595	80	0.0135
		27	0.1440	54	0.0550		

BACK TO INDEX

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Multiply	by	to get equivalent number of:
LENGTH		
Inch	25.4	millimetres (mm)
Foot	0.304 8	metres (m)
Yard	0.914 4	metres
Mile	1.609	kilometres (km)
AREA		
Inch^2	645.2	millimetres^2 (mm^2)
	6.45	centimetres^2 (cm^2)
Foot^2	0.092 9	metres^2 (m^2)
Yard^2	0.836 1	metres^2
VOLUME		
Inch^3	16 387.	mm^3
	16.387	cm^3
	0.016 4	litres (l)
Quart	0.946 4	litres
Gallon	3.785 4	litres
Yard^3	0.764 6	metres^3 (m^3)
MASS		
Pound	0.453 6	kilograms (kg)
Ton	907.18	kilograms (kg)
Ton	0.907	tonne (t)
FORCE		
Kilogram	9.807	newtons (N)
Ounce	0.278 0	newtons
Pound	4.448	newtons
TEMPERATURE		
Degree Fahrenheit	(†°F-32) ÷ 1.8	degree Celsius (C)



Multiply	by	to get equivalent number of:
ACCELERATION		
Foot/sec^2	0.304 8	metre/sec^2 (m/s^2)
Inch/sec^2	0.025 4	metre/sec^2
TORQUE		
Pound-inch	0.112 98	newton-metres (N-m)
Pound-foot	1.355 8	newton-metres
POWER		
Horsepower	0.746	kilowatts (kW)
PRESSURE OR STRESS		
Inches of water	0.249 1	kilopascals (kPa)
Pounds/sq. in.	6.895	kilopascals
ENERGY OR WORK		
BTU	1 055.	joules (J)
Foot-pound	1.355 8	joules
Kilowatt-hour	3 600 000. or 3.6x10^6	joules (J = one W's)
LIGHT		
Foot candle	1.076 4	lumens/metre^2 (lm/m^2)
FUEL PERFORMANCE		
Miles/gal	0.425 1	kilometres/litre (km/l)
Gal/mile	2.352 7	litres/kilometre (l/km)
VELOCITY		
Miles/hour	1.609 3	kilometres/hr. (km/h)

METRIC-ENGLISH CONVERSION TABLE

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DECIMAL AND METRIC EQUIVALENTS

Fractions	Decimal In.	Metric MM.	Fractions	Decimal In.	Metric MM.
1/64	.015625	.39688	33/64	.515625	13.09687
1/32	.03125	.79375	17/32	.53125	13.49375
3/64	.046875	1.19062	35/64	.546875	13.89062
1/16	.0625	1.58750	9/16	.5625	14.28750
5/64	.078125	1.98437	37/64	.578125	14.68437
3/32	.09375	2.38125	19/32	.59375	15.08125
7/64	.109375	2.77812	39/64	.609375	15.47812
1/8	.125	3.1750	5/8	.625	15.87500
9/64	.140625	3.57187	41/64	.640625	16.27187
5/32	.15625	3.96875	21/32	.65625	16.66875
11/64	.171875	4.36562	43/64	.671875	17.06562
3/16	.1875	4.76250	11/16	.6875	17.46250
13/64	.203125	5.15937	45/64	.703125	17.85937
7/32	.21875	5.55625	23/32	.71875	18.25625
15/64	.234375	5.95312	47/64	.734375	18.65312
1/4	.250	6.35000	3/4	.750	19.05000
17/64	.265625	6.74687	49/64	.765625	19.44687
9/32	.28125	7.14375	25/32	.78125	19.84375
19/64	.296875	7.54062	51/64	.796875	20.24062
5/16	.3125	7.93750	13/16	.8125	20.63750
21/64	.328125	8.33437	53/64	.828125	21.03437
11/32	.34375	8.73125	27/32	.84375	21.43125
23/64	.359375	9.12812	55/64	.859375	21.82812
3/8	.375	9.52500	7/8	.875	22.22500
25/64	.390625	9.92187	57/64	.890625	22.62187
13/32	.40625	10.31875	29/32	.90625	23.01875
27/64	.421875	10.71562	59/64	.921875	23.41562
7/16	.4375	11.11250	15/16	.9375	23.81250
29/64	.453125	11.50937	61/64	.953125	24.20937
15/32	.46875	11.90625	31/32	.96875	24.60625
31/64	.484375	12.30312	63/64	.984375	25.00312
1/2	.500	12.70000	1	1.00	25.40000

BACK TO INDEX

DAVE GRAHAM AUTO LITERATURE, INC.
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Subject	Page No.
A	
ACCESSORIES:	
Cruise Control	15-2
Guidematic	15-12
Lamp Monitor System	12-41
Radio and Antenna	12-45
Rear Window Defogger	15-25
Sunroof	15-37
Theft Deterrent System	15-29
Twilight Sentinel	15-18
Washer Fluid Low Level Indicator	12-43
ACCESSORY INSTALLATION, ELECTRICAL	12-61
Eldorado	7-76
Except Eldorado	7-24
ADJUSTING:	
A.L.C. System Trim	4-20
Back-Up Lamp and Neutral Switch	12-40
Hood	11-2
Hood Latch	11-2
Ignition Timing:	
Non EFI	6-30
EFI	6-131
Idle Speed Carb.	6-80
Idle Speed E.F.I.	6-131
Spark Plug Gap	6-51
Transmission Downshift Switch	7-23
ADJUSTMENT:	
A/C Components Front	1-62
A/C Components Rear	1-109
Carburetor Overhaul	6-76
Drive Belts	6-11
Guidematic Vertical Aim	15-17
Parking Brake	5-10
Radio	12-56
Rear Brake Shoes	5-10
Rear Wheel Bearing (Eldorado)	4-42
Stop Light Switch	5-11
Sunroof	15-39
Transmission Linkage:	
Eldorado	7-76
Except Eldorado	7-22
AIMING, HEADLIGHTS	12-9
AIR CLEANER	6-55
AIR CONDITIONING, FRONT:	
Adjustments	1-62
Air Flow at Various Lever Setting	1-24
Ambient Switch and Sensor Assembly	1-53
Blower-Evaporator Assembly, R & I	1-64
Blower Circuit at Various Setting	1-39
Blower Motor Assembly, R & I	1-72
Blower Problem Diagnosis	1-47
Checking Refrigerant Charge	1-58
Diagnosis of Problems	1-39
Pressure Relief Valve	1-85
Refrigeration Problems	1-51
Superheat Switch	1-85
System Operation at Various Setting	1-31
Test	1-45
Torque Specifications	1-121
Tubing Torque Specifications	1-63
Vacuum Circuits	1-17
Vacuum Problem Diagnosis	1-49
Water Control Valve R & I	1-73
Control System Operational	1-14
Mode Door Operational	1-17
Compressor:	
Belt Adjustment	6-11
Clutch Coil and Housing Assembly	1-80
Clutch Plate and Hub Assembly	1-75
Component Adjustments	1-61
Control System Functional	1-61
Control System Components	1-11
General Information	1-0
Electrical Circuits	1-15
Pulley Bearing	1-79
Shaft Seal	1-83
Internal Mechanism:	
Assembly	1-85
Disassembly	1-87
Gaging Operation	1-89
Installation	1-94
Removal	1-85
Leak Testing	1-98
Overhaul	1-75
Pulley and Bearing Assembly	1-78
Pulley Bearing Replacement	1-79
Removal and Installation, Complete	1-85
Removal and Installation, Partial	1-85
Compressor Overhaul	1-75
Shaft Seal Assembly	1-83
Condenser, R and I	1-66
Connecting Charging Station, J-23500	1-59
Control Panel:	
Disassembly and Assembly	1-74
Removal and Installation	12-67
Diagnosis of Air Conditioner Problems	1-39
Duct, Left Side	12-68
Duct, Right Side	12-68
Evacuating A/C System	1-59
Evaporator Case, R and I	1-64
Evaporator Core, R and I	1-71
Expansion Valve, R and I	1-69
Heater Case, R and I	1-72
Heater Core	1-73
In-Car Sensor and Switch	12-67
Leak Testing Refrigeration System	1-61
Maintaining Chemical Stability	1-55
Maintenance and Inspection	1-57
Oil, Compressor	1-78
Outlet	1-12
Performance Test	1-45
Precautions in Handling Refrigerant	1-56
Programmer Overhaul	1-99
Programmer, R and I	1-71
Purging, Evacuating and Charging the Refrigeration System	1-58
Sensors:	
Ambient in Car R & I	12-67
Special Tools	1-120
Standard Service Procedures	1-55

BACK TO INDEX

DAVE GRAHAM AUTO LITERATURE, INC.
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Subject	Page No.
Superheat Switch	1-74
Temperature Dial, Adjustment	1-62
Temperature Door Link Adjustment	1-62
Theory of Operation:	
Electrical Circuit Diagram	1-65
Vacuum Circuit Diagram	1-23
Water Control Valve	1-73
AIR CONDITIONING, REAR:	
Adjustments	1-109
Amplifier	1-114
Automatic Climate Control Tester, Connecting	1-109
Automatic Climate Control System, Testing	1-110
Blower-Evaporator Assembly, R and I	1-117
Blower Motor Assemblies, R and I	1-115
Blower Resistor, R and I	1-115
Cooling Performance Test	1-109
Control Panel, Rear:	
Disassembly and Assembly	1-114
Removal and Installation	1-113
Duct Sensor	1-114
Electrical Circuit	1-106
Evaporator Core, R and I	1-119
Expansion Valve, R and I	1-119
Heater Core	1-119
In-Car Sensor	1-114
Master Switch, R & I	1-115
Mode Door Assemblies	1-115
Performance Test	1-109
Power Servo, R and I	1-115
Power Servo Vacuum Valve, R and I	1-115
Sensors:	
Duct	1-114
In-Car	1-114
Special Tools	1-120
Suction Throttling Valve, R and I	1-117
Testing Automatic Climate Control System	1-45
Theory of Operation	1-102
Transducer	1-117
Water Control Valve	1-114
AIR OUTLET:	
Climate Control Right or Left, R and I	12-61
A.I.R. SYSTEM:	
Check Valve, R & I	6-147
Diverter Valve, R & I	6-147
General Description	6-142
Pump, R & I	6-148
Pump Diagnosis	6-144
Pump Fan, R & I	6-148
ALARM, THEFT DETERRENT	15-29
ALIGNMENT, CONNECTING ROD	6-184
ALIGNMENT, EXHAUST SYSTEM:	
(Eldorado)	8-11
(Except Eldorado)	8-9
ALIGNMENT, FRONT SUSPENSION:	
(Eldorado)	3-29
(Except Eldorado)	3-3
AMPLIFIER, GUIDE-MATIC R & I	15-17
AMPLIFIER, REAR A/C UNIT	1-14
AMPLIFIER, TWILIGHT SENTINEL R & I	12-66
ANALYZING CHARGING CIRCUIT TROUBLES	6-37
ANTENNA POWER:	
Diagnosis	12-54
Service Information	12-59
ASH TRAY, R & I	12-69
A.T.C. TESTER, USE OF (FRONT A/C SYSTEM)	1-54
A.T.C. TESTER, USE OF (REAR A/C SYSTEM)	1-109
AUTOMATIC LEVEL CONTROL:	
Checking	4-17
Compressor:	
Disassemble & Assemble	4-20
Removal & Installation	4-20
Output Test	4-17
Control Valve:	
Removal & Installation	4-20
Testing	4-18
General Description	4-15
Leak Test	4-19
Regulator Test	4-19
Trim Adjustment	4-20
Tubing	4-20
AXLE, DRIVE AND OUTPUT SHAFT, ELDORADO	
Left	3-34
Right	3-47
AXLE (SEE REAR AXLE)	4-36

B

BACKLASH CORRECTION, DIFFERENTIAL	4-61
BACK-UP LAMP:	
Diagnosis	12-9
Removal & Installation:	
Eldorado	12-20
Except Eldorado	12-16
Switch:	
Adjustment	12-40
R & I	12-40
BALANCER, CRANKSHAFT PULLEY AND HUB, R & I	6-175
BALANCING PROPELLER SHAFT	4-26
BALL STUD SEAT ASSEMBLY, DRIVE SHAFT	4-32
BAR, FRONT STABILIZER, R & I:	
Eldorado	3-31
Except Eldorado	3-12
BAR, TORSION (ELDORADO)	3-34
BATTERY:	
Cable Service	6-8
Causes of Low Battery Condition	6-18
Charge Indicator	6-16
Charging Instructions	6-19
Diagnosis	6-16
Load Test	6-18
Push or Pull Starting	6-17

BACK TO INDEX

DAVE GRAHAM AUTO LITERATURE, INC.
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Subject	Page No.
Testing	6-17
Visual Inspection	6-16
BEARINGS:	
A/C Compressor	1-79
Camshaft	6-178
Connecting Rod	6-181
Main	6-184
Wheel (Front)	3-22
BELT ADJUSTMENTS	6-11
BODY:	
Name Plate	0-3
Style Numbers	0-3
BODY MOUNTS:	
Except Eldorado	2-5,7
Eldorado	2-8
BODY SHEET METAL TOLERANCES:	
Except Eldorado	11-9
Eldorado	11-10
BRAKES (ELDORADO):	
Combination Valve	5-49,57
Diagnosis Chart	5-50
Rotor Assembly, R & I	5-51
Hoses & Piping	5-57
Parking Brake	5-55
Parking Brake Adjustment	5-56
Rear Brake Caliper, R & I	5-51
Rear Brake Caliper Piston Assembly	5-54
Specifications	5-68
Theory of Operation	5-49
Torque Specifications	5-69
BRAKES (EXCEPT ELDORADO):	
Brake Hose Assembly	5-7
Bleeding	5-8
Contaminated Fluid	5-7
Diagnosis	5-5
Fluid Recommendations	5-5
Front Disc Brakes:	
Caliper, D & A	5-14
Caliper, R & I	5-13
Lining Break-In	5-13
Relining	5-11
Servicing Rotor	5-16
Theory of Operation	5-3
Hose Assembly	5-22
Hub & Rotor	5-15
Hydraulic Lines:	
Combination Valve, R & I	5-21
Flaring	5-23
Servicing	5-22
Tubing	5-23
Hydra-Boost – See Hydra-Boost	5-59
Master Cylinder, D & A	5-24
Parking Brake:	
Adjustment	5-10
Assembly, R & I	5-20
Cable, R & I	5-21
Checks	5-7
Vacuum Diaphragm	5-20
Power Unit:	
Disassembly & Assembly	5-24
Removal & Installation	5-24

Subject	Page No.
Rear Drum Brakes:	
Machining Drums	5-18
Relining	5-17
Wheel Cylinder Service	5-19
Shoe Adjustment	5-10
Shoe Assemblies	5-17
Specifications	5-33
Stoplight Switch Adjustment	5-11
Testing Brake Tell-Tale Light Operation	5-7
Theory of Operation	5-3
Torque Specifications	5-34
Vacuum Power Head, D & A	5-26
BRAKE RELEASE SWITCH, CRUISE CONTROL	5-11
BRAKES, TRACKMASTER - SEE TRACKMASTER	5-35
BULB DATA CHART	12-22
BULB REPLACEMENT:	
Eldorado	12-23
Except Eldorado	12-19
BUSHING, FRONT LOWER CONTROL ARM:	
Eldorado	3-38
Except Eldorado	3-20
BUSHING, UPPER CONTROL ARM, FRONT:	
Eldorado	3-32
Except Eldorado	3-17
BUMPERS (EXCEPT ELDORADO):	
Front Bumper:	
Center Bar, Lower	14-7
Energy Absorbing Unit	
Checking	14-4
R & I	14-4
Guards	14-7
Impact Strip, Center	14-7
Impact Strip, Outer	14-7
License Plate Bracket	14-7
Outer End, Lower	14-8
Outer End, Upper	14-8
R & I	14-8
General Description	14-1
Rear Bumper:	
Fuel Filler Door	14-13
Impact Strip	14-8
Mounting Bracket, Lower	14-12
Outer End	14-10
Quarter Filler Panel	14-10
R & I	14-8
Testing Front Energy Absorber	14-1
Torque Specifications	14-16
BUMPERS (ELDORADO):	
Front Bumper:	
Fender Filler Panel	14-14
Outer End	14-14
General Description	14-13
Rear Bumper:	
Impact Strip, Vertical	14-14
Outer End	14-15
Rear Quarter Filler Panel	14-15
Reflex Assembly	14-14
Torque Specifications	14-16
BUZZER DIAGNOSIS, IGNITION KEY WARNING	9-25

BACK TO INDEX

DAVE GRAHAM AUTO LITERATURE, INC.
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Subject	Page No.
C	
CABLE, SUN ROOF	15-43
CABLES, PARKING BRAKE, R & I:	
Eldorado	5-55
Except Eldorado	5-21
CALIPER, BRAKE:	
Disassembly & Assembly	5-14
Removal & Installation	5-13
CAMSHAFT, R & I	6-178
CAMSHAFT BEARING, R & I	6-178
CANISTER, E.C.S. VAPOR, R & I	6-153
CAPACITIES, FLUID	0-17
CARBURETOR:	
Adjustments:	
Air Valve Spring	6-80
Air Valve Dash Pot	6-77
Automatic Choke Coil	6-78
Choke Coil Lever	6-76
Fast Idle	6-76
Fast Idle Cam	6-77
Float	6-74
Front Vacuum Break	6-77
Idle Mixture and Speed (On Car)	6-80
Pump Rod	6-76
Rear Vacuum Break	6-78
Secondary Closing	6-79
Secondary Lock-Out	6-79
Secondary Opening	6-79
Secondary Throttle Valve Lock-Out Opening	6-79
Unloader	6-78
Air Horn Assembly	6-75
Air Horn Disassembly	6-70
Air Horn-To-Bowl Assembly	6-75
Air Horn Removal	6-69
Diagnosis	6-63
Float Bowl Assembly	6-72
Float Bowl Disassembly	6-70
Fuel Pump Tests	6-82
General Description	6-53
R & I	6-68
Specifications	6-83
Throttle Body Assembly	6-72
Throttle Body Disassembly	6-72
Torque Specifications	6-84
Catalytic Converter Replacement on Car	8-12
Catalytic Converter Bottom Cover Replacement	8-14
CHARGING REFRIGERATION SYSTEM	1-58
CHARGING SYSTEM (H.D. GENERATOR):	
Diagnosis	6-39
Generator, D & A	6-46
Generator, R & I	6-45
Generator, Inspection & Testing	6-47
Theory of Operation	6-35
CHARGING SYSTEM (EXCEPT H.D. GENERATOR):	
Diagnosis	6-37
Generator:	
Disassemble & Assemble	6-42
Removal & Installation	6-40
Inspection & Testing	6-43
Special Tools	6-52
Specifications	6-51
Theory of Operation	6-35
Torque Specifications	6-52
CHASSIS CIRCUIT DIAGRAMS–(SEE GATEFOLDS INSIDE BACK COVER)	
CHASSIS SHEET METAL–(SEE SHEET METAL)	
CHECK VALVE, STEERING GEAR	9-47
CHECKING:	
Frame Dimensions	2-4
Frame for Twist	2-4
Front Shock Absorbers	3-11
Power Steering Pump Fluid Level	9-27
Power Steering Pump Pressure	9-27
Refrigerant Charge	1-58
Spherical Joint	3-13,32
Steering Linkage Parallelism:	
Eldorado	9-71
Except Eldorado	9-28
Transmission Fluid:	
Eldorado	7-76
Except Eldorado	7-24
CHOKE SYSTEM	6-62
CIGAR LIGHTER, R & I	12-69
CLIMATE CONTROL TESTER	
Front A/C System	1-54
Rear A/C System	1-109
CLOCK, R & I	12-73
CLUSTER, INSTRUMENT PANEL	12-64
COLUMN STEERING:	
Removal and Installation	9-53
Standard, D & A	9-56
T & T, D & A	9-62
COMBINATION VALVE, BRAKE:	
Eldorado	5-49,57
Except Eldorado	5-21
COMPRESSOR, A/C:	
Overhaul	1-75
R & I Complete	1-64
R & I Partial	1-64
COMPRESSOR, A.L.C.:	
Disassemble & Assemble	4-20
Output Test	4-17
Removal & Installation	4-18
CONDENSER, A/C, R & I	1-66
CONNECTING ROD BEARING CLEARANCE CHECKING AND REPLACEMENT	6-181
CONNECTING ROD AND PISTON, R AND I	6-180
CONSTANT VELOCITY JOINT (DOUBLE CARDAN):	
Ball Stud Seat	4-32
Link Yoke	4-32
Ball Support Yoke	4-31
Slip Yoke	4-31
Universal Joint Cross	4-29
CONSTANT VELOCITY JOINT, INNER (ELDORADO)	3-39

BACK TO INDEX

DAVE GRAHAM AUTO LITERATURE, INC.
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Subject	Page No.
CONSTANT VELOCITY JOINT, OUTER (ELDORADO)	3-38
CONTROL ARM, REAR (ELDORADO):	
Lower	4-11
Upper	4-11
Upper Bushing	4-11
CONTROL ARM, REAR (EXCEPT ELDORADO):	
Lower	4-6
Upper	4-6
CONTROL PANEL:	
Front A/C:	
Disassemble & Assemble	1-74
Removal & Installation	12-67
Rear A/C:	
Disassemble and Assemble	1-114
Removal & Installation	1-113
CONTROL SWITCH:	
Convertible Top	12-72
Cruise Control	12-70
Power Antenna	12-72
Rear Window Defogger	12-72
Sunroof	12-72
Theft Deterrent System	15-29
CONTROL SYSTEM FUNCTIONAL TEST (A/C)	1-61
CONTROL UNIT, REAR RADIO	12-57
CONTROL VALVE TEST, A.L.C.	4-18
CONTROL VALVE, WATER, R & I:	
Front A/C	1-173
Rear A/C	1-114
CONTROLLED DIFFERENTIAL, D & A	4-61
CONTROLLER, THEFT DETERRENT SYSTEM	15-29
CONTROLLER–MODULATOR HARNESS, TRACKMASTER	5-48
CONTROLLER, TRACKMASTER	5-48
CONTROLS, DISTRIBUTOR VACUUM ADVANCE	6-28
CONTROLS, EMISSION– SEE EMISSION CONTROLS	
CONVERTER, TRANSMISSION:	
Eldorado	7-82
Except Eldorado	7-30
CONVERTIBLE TOP SWITCH, R & I	12-72
COOLING CAPACITY PERFORMANCE TEST (A/C)	
Rear System	1-109
COOLING SYSTEM, ENGINE:	
Belt Adjustments	6-11
Diagnosis	6-2
Fan, R & I	6-8
Flushing	6-7
General Description	6-5
Leak Testing	6-6
Maintenance	6-7
Special Tools	6-15
Specifications	6-14
Testing Coolant	6-7
Thermostat, R & I	6-8
Thermostat Test	6-7
Torque Specifications	6-15
Water Pump Overhaul	6-9
COOLER SERVICING, POWER STEERING	9-28
CORNERING LAMP:	
Diagnosis	12-5
Eldorado	12-19
Except Eldorado	12-15
COVER, FRONT ENGINE, R & I	6-177
COVER, ROCKER ARM, R & I	6-166
CRADLE, RADIATOR:	
Eldorado	13-4
Except Eldorado	13-4
CRANKCASE VENTILATION SYSTEM	6-141
CRANKING VOLTAGE TEST	6-21
CRANKSHAFT PULLEY AND HUB	6-175
CRANKSHAFT, R & I	6-175
CROSS ROD BODY, (ELDORADO) INSTALLATION	2-5
CRUISE CONTROL	
Brake Release Switch, R & I	15-11
Diagnosis:	
Electrical Check-Out	15-7
Release Switches	15-6
Servo and Vacuum Check-Out	15-8
Engagement Switch, R & I	15-11
On-Off Switch, R & I	12-70
Servo	15-12
Theory of Operation	15-2
Transducer	15-12
CYLINDER, HEAD, R & I	6-171
CYLINDER, WHEEL SERVICING	5-19

D

DAMPER, PROPELLER SHAFT TORSIONAL (6F-6Z)	4-28
DASH UNIT, FUEL GAGE, R & I	12-72
DECIMAL AND METRIC EQUIVALENTS	16-4
DE-FOGGER, REAR WINDOW – SEE REAR WINDOW DE-FOGGER	
DEMOUNTING TIRES	10-3
DETERRENT, THEFT ALARM SYSTEM	15-29
DIAGNOSIS:	
Air Conditioning:	
Auxiliary Vacuum Problems	1-39
Blower Control Circuits Problems	1-47
How to Isolate the Problem	1-39
Low Refrigerant Detection System	1-53
Refrigeration Problems	1-51
Temperature Control Problems	1-41
Use of A.T.C. Tester	1-54
Automatic Level Control	4-15
Back-Up Lamps	12-9
Battery	6-16
Brakes	5-1
Carburetor	6-63
Charging System (Except H.D.)	6-37
Charging System (H.D. Generator)	6-39
Cooling System	6-5
Cornering Lights	12-5

BACK TO INDEX

DAVE GRAHAM AUTO LITERATURE, INC.
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Subject	Page No.
Cruise Control	15-6
Electrical and Instruments:	
Combination Valve	12-31
Fuel Gage	12-29
Hi-Beam Indicator	12-31
Metal Temperature Indicator	12-31
Oil Pressure Indicator	12-32
Printed Circuit	12-35
Trunk Lid	12-31
Water Temperature Indicator	12-32
Front Suspension	3-3
Front Wheel Drive	3-45
Fuel Injection	6-92
Fuel Monitor System	15-35
Guide-Matic	15-14
Headlights	12-3
Ignition System	6-28
Lamp Monitor	12-41
Marker Lamps	12-6
P.C.V. Valve	6-141
Radio	12-50
Rear Axle	4-36
Rear De-Fogger	15-26
Starting System	6-21
Steering:	
Gear and Pump	9-8
Key Buzzer	9-25
Linkage	9-14
Standard Column	9-15
Turn Signal Switch	9-22
T & T Column	9-18
Stop Lights	12-8
Sun Roof	15-39
Tail, Park, License Lamps	12-7
Theft Deterrent System	15-32
Trackmaster	5-35
Transmission (Eldorado)	7-78
Transmission (Except Eldorado)	7-28
Turn Signals and Hazard Warning	12-4
Twilight Sentinel	15-20
Washer Fluid Level Indicator	12-44
DIAPHRAGM, PARKING BRAKE VACUUM, R & I	5-20
DIFFERENTIAL:	
Backlash Variance Correction	4-61
Controlled	4-46
Controlled, Disassembly and Assembly	4-61
Gear Ratios	4-46
General Description	4-46
Lubrication	0-15
Overhaul	4-49
Pinion Shim Chart	4-65
Pinion Flange Run-Out, Checking on Car	4-64
Side Bearing Shim Chart	4-66
Special Tools	4-67
Torque Specifications	4-66
DISTRIBUTOR:	
Disassembly and Assembly	6-32
Removal and Installation	6-32
Test Information	6-30
DIVERTER VALVE, A.I.R.	6-147
DOOR, GLOVE BOX, R & I	12-74
DOWNSHIFT SWITCH, TRANSMISSION	7-23
DRAIN HOSE REPLACEMENT, SUN ROOF	15-47
DRILL SIZES	16-2
DRIVE BELTS, ADJUSTMENT	6-11
DRIVE SHAFT:	
Centering Ball	4-32
Center Bearing, R & I (6DF-6ZZ)	4-34
Front Section, D & A (6DF-6ZZ)	4-33
General Description	4-25
Link Yoke	4-32
Balancing	4-26
Shaft Assembly, R & I (Except 6DF-6ZZ)	4-27
Shaft Assembly, R & I (6DF-6ZZ)	4-28
Slip Yoke, R & I	4-31
Torsional Damper, R & I (6DF-6ZZ)	4-28
Universal Joint Cross	4-29
DRUM BRAKES – SEE BRAKES	
DRUM, REAR WHEEL BRAKE, R & I	5-17
DUCT, A/C:	
Left Side, R & I	12-68
Right Side, R & I	12-68

E

EEVIR	
Assembly R & I	1-66
Desiccant Replacement	1-66
Drier Desiccant R & I	1-67
Pick Up Tube	1-70
Sight Glass R & I	1-70
STV Valve/X Valve R & I	1-69
ELECTRICAL ACCESSORY INSTALLATION	12-61
ELECTRICAL CHASSIS DIAGRAMS – SEE GATEFOLDS ON INSIDE BACK COVER	
ELECTRICAL, ENGINE – (SEE ENGINE ELECTRICAL)	
ELECTRICAL INSTRUMENTS:	
Diagnosis	12-29
General Description	12-28
EMISSION CONTROLS:	
A.I.R. Check Valve, R & I	6-147
A.I.R. Diverter, R & I	6-147
A.I.R. Pump, R & I	6-148
A.I.R. Pump Fan, R & I	6-148
Diagnosis	6-141
E.C.S. Canister, R & I	6-153
E.C.S. Canister Filter, R & I	6-155
EGR Valve	6-150
General Description	6-141
Maintenance	0-14
P.C.V. Valve, R & I	6-142
Thermac Air Cleaner Testing (Non E.F.I.)	6-147
Thermac Sensor, R & I	6-148
Thermac Vacuum Motor, R & I	6-149
ENGAGEMENT SWITCH, CRUISE CONTROL, R & I	12-70

BACK TO INDEX

DAVE GRAHAM AUTO LITERATURE, INC.
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Subject	Page No.
ENGINE:	
Camshaft, R & I	6-178
Camshaft Bearing, R & I	6-178
Connecting Rod Alignment	6-184
Connecting Rod Bearing	6-181
Connecting Rod & Piston, R & I	6-180
Crankshaft, R & I	6-179
Crankshaft Pulley and Hub, R & I	6-175
Cylinder Head, R & I	6-171
Dipstick Tube Installation	6-185
Exhaust Manifold, R & I	6-166
Front Cover, R & I	6-177
Front Cover Oil Seal, R & I	6-177
General Description	6-156
Intake Manifold, R & I	6-165
Lubrication System	6-157
Main Bearing Checking & Replacement	6-184
Mounts, R & I:	
Eldorado	6-164
Except Eldorado	6-163
Oil Pan, R & I	6-173
Oil Pump, R & I	6-174
Oil Pump Servicing	6-174
Piston:	
Clearance	6-183
Pin, R & I	6-182
Ring Replacement	6-182
Rear Main Seal, R & I	6-175
Rocker Arm Covers, R & I	6-166
Removal and Installation:	
Eldorado	6-161
Except Eldorado	6-158
Special Tools	6-191
Specifications	6-187
Torque Specifications	6-189
Valve, R & I	6-172
Valve Lifter:	
Disassemble and Assemble	6-170
Leak Down Rate Checking	6-169
Removal and Installation	6-169
Valve & Seat Reconditioning	6-173
Valve Spring, R & I	6-120
ENGINE COOLING – SEE COOLING SYSTEM	
ENGINE FUEL – SEE FUEL SYSTEM	
ENGINE ELECTRICAL:	
Battery	6-16
Charging System	6-37
Generator	6-35
Ignition System	6-27
Starting System	6-20
ENGINE OIL CHANGE INTERVAL AND VISCOSITY CHART	0-16
ENGINE OIL RECOMMENDATIONS	0-16
EVACUATING REFRIGERATION SYSTEM	1-59
EVAPORATIVE CONTROL SYSTEM (E.C.S.):	
General Description	6-153
Vapor Canister, R & I	6-153
Vapor Canister Filter, R & I	6-155
EVAPORATOR (A/C):	
Case R & I (Front)	1-64
Case, R & I (Rear)	1-119
Core, R & I (Front)	1-74
Core, R & I (Rear)	1-117
EXHAUST GAS RECIRCULATION (E.G.R.):	
Exhuast Pressure Transducer	6-153
Control Valve Functional Check	6-150
Operation (Except E.F.I.)	6-150
Port Cleaning	6-152
Valve Cleaning	6-151
Valve Functional Check	6-150
EXHAUST SYSTEM (ELDORADO):	
Alignment	8-12
EFE Valve, R & I	8-7
General Description	8-8
Manifold, R & I	6-122
Torque Specifications	8-15
EXHAUST SYSTEM (EXCEPT ELDORADO):	
Alignment	8-12
EFE Valve, R & I	8-7
General Description	8-6
Manifold, R & I	6-122
Torque Specifications	8-15
EXPANSION VALVE, R & I:	
Front A/C	1-169
Rear A/C	1-119
EXTENSION HOUSING, TRANSMISSION, R & I	7-26
EXTENSION HOUSING OIL SEAL, R & I	7-26
F	
FAN, ENGINE COOLING, R & I	6-8
FAN, A.I.R. PUMP, R & I	6-148
FENDER, FRONT, R & I:	
Eldorado	11-5
Except Eldorado	11-3
FILTER:	
Air Cleaner	0-14
E.C.S. Vapor Canister	6-155
Fuel-Non EFI	6-54
EFI	6-127
FINAL DRIVE:	
R & I (Eldorado)	3-54
FLARING BRAKE TUBING	5-23
FLOAT UNIT, FUEL TANK, R & I	8-5
FLUID CAPACITIES	0-17
FLUID COOLER SERVICING, STEERING PUMP	9-28
FLUID LEAKAGE PRECAUTIONS, TRANSMISSION	7-19
FLUID LEVEL CHECKING	0-11
FLUID LEVEL CHECKING, POWER STEERING PUMP	9-27
FLUID LEVEL INDICATOR, WINDSHIELD WASHER – SEE WASHER FLUID LEVEL INDICATOR SYSTEM	
FLUSHING COOLING SYSTEM	6-7
FOOT SWITCH, GUIDE-MATIC, R & I	15-17

BACK TO INDEX

DAVE GRAHAM AUTO LITERATURE, INC.
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Subject	Page No.
FRAME, CHECKING DIMENSIONS	2-4
FRAME, CHECKING FOR TWIST	2-4
FRAME, GENERAL DESCRIPTION	2-5
FRONT BUMPER, R & I	14-5
FRONT COVER, ENGINE, R & I	6-177
FRONT COVER OIL SEAL, ENGINE R & I	6-177
FRONT DISC BRAKES – SEE BRAKES	
FRONT SUSPENSION (ELDORADO):	
Alignment	3-29
General Description	3-27
Hub, Bearing and Retainer	3-39
Lower Control Arm:	
Bushing	3-38
Spherical Joint	3-39
Spherical Joint Seal	3-37
Shock Absorber, R & I	3-31
Spherical Joint Checking	3-32
Stabilizer Bar, R & I	3-31
Standing Height Adjustment	3-27
Steering Knuckle & Inner Seal	3-35
Torsion Bar, R & I	3-34
Upper Control Arm:	
Bushing	3-32
Spherical Joint	3-33
Wheel Alignment Specifications	3-29
FRONT SUSPENSION (EXCEPT ELDORADO):	
Alignment	3-6
Diagnosis Chart	3-4
General Description	3-3
Lower Spherical Joint:	
Seal	3-15
Seal Repacking	3-15
Lower Suspension Arm & Coil Spring	3-19
Lower Suspension Arm Bushing	3-21
Standing Height Check	3-7
Shock Absorber Check	3-11
Shock Absorber, R & I	3-11
Special Tools	3-26
Stabilizer Bar, R & I	3-12
Steering Knuckle, R & I	3-20
Tie Strut & Bushings	3-12
Torque Specifications	3-25
Upper Spherical Joint Seal Replacement	3-13
Upper Suspension Arm	3-17
Upper Suspension Arm Shaft & Bushing	3-17
Wheel Alignment Specifications	3-29
Wheel Bearings	3-22
FRONT SUSPENSION MAINTENANCE	0-13
FRONT WHEEL DRIVE (ELDORADO):	
Constant Velocity Joint:	
Inner	3-51
Outer	3-48
Diagnosis	3-45
Final Drive, R & I	3-54
General Description	3-45
Output Shaft and Drive Axle:	
Left	3-48
Right	3-47
Output Shaft Seal	3-53
Pinion Bearing Oil Seal, R & I	3-56
Special Tools	3-58
Torque Specifications	3-57
FUEL GAGE DASH UNIT, R & I	12-72
FUEL FILTER DOOR, R & I	14-13
FUEL INJECTION:	
Adjustments:	
Idle Speed	6-131
Ignition Timing and Idle Speed	6-131
Throttle Position Switch	6-131
Air Temperature Sensor, R & I	6-128
Chassis Mounted Fuel Pump - R & I	6-127
Coolant Temperature Sensor - R & I	6-128
Diagnosis - EFI Problems	6-92
Distributor Service and Testing	6-129
Electronic Control Unit - R & I	6-118
Fast Idle Valve - R & I	6-122
Fuel Filter Assembly	6-127
Fuel Pressure Regulator - R & I	6-123
Fuel Rail - R & I	6-124
Fuel Tank - R & I	6-128
General Information:	
Relieving Fuel Pressure	6-134
Differences in Fuel Injection Equipped Vehicles	6-134
Difference Between "C" and "E" Cars	6-137
Reference Drawings	6-138
Injection Valve - R & I	6-123
Intake Manifold - R & I	6-122
In-Tank Fuel Pump - R & I	6-127
Relationship between EFI and Carburetor Components	6-94
Subsystem Description	6-87
Air Induction Subsystem	6-89
Electronic Control Unit	6-91
Engine Sensors	6-90
Fuel Delivery Subsystem	6-87
Torque Specifications	6-140
Testing using Analyzer J-25400	6-94
Theory of Operation	6-86
Throttle Body Assembly - R & I	6-120
Throttle Position Switch - R & I	6-121
FUEL SYSTEM, ENGINE:	
Carburetor:	
Assembly	6-72
Diagnosis Charts	6-63
Disassembly	6-69
Overhaul Adjustments	6-76
Specifications	6-83
Fuel Filter Non EFI	6-54
EFI	6-124
Fuel Pump Specifications Non EFI	6-84
Fuel Pump Tests	6-82
Special Tools	6-85
Torque Specifications	6-84
FUEL, TANK DRAINING, R & I	8-4
FUEL TANK FLOAT UNIT, R & I	8-3
FUEL TANK, R & I	8-3
FUNCTIONAL TEST OF A/C CONTROL SYSTEM	1-45

BACK TO INDEX

DAVE GRAHAM AUTO LITERATURE, INC.
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Subject	Page No.
FUSE CHART	12-26
FUSIBLE LINK REPAIR	12-27
G	
GEAR BOX, SUN ROOF	15-42
GENERAL INFORMATION	0-1
GENERATOR – SEE CHARGING SYSTEM	
GLOVE BOX:	
Door, R and I	12-74
Liner, R and I	12-73
Lock, R and I	12-74
GREASE RETAINER, REAR AXLE (ELDORADO)	4-43
GRILLE:	
General Description	13-2
Lower, R & I	13-7
Upper, R & I	13-6
GUARD, FRONT BUMPER	14-5
GUIDE-MATIC:	
Circuit Diagram	15-15
Control Switch, R & I	12-70
Diagnosis	15-14
Diagnosis Chart	15-16
Foot Switch, R & I	15-17
Photo-Amplifier, R & I	15-17
Power Relay, R & I	15-17
Theory of Operation	15-12
Vertical Aiming Adjustment	15-17
H	
HANDLING REFRIGERANT AND REFRIGERATION COMPONENTS	1-55
HARNESS, LAMP MONITOR FRONT, R & I	12-41
HARNESS, TRACKMASTER:	
Controller - Modulator, R & I	5-48
HAZARD WARNING DIAGNOSIS	12-4
HEAD, CYLINDER, R & I	6-171
HEADLIGHT:	
Aiming:	
With Screen	12-11
Without Screen, Mechanical Method	12-9
Diagnosis	12-3
Housing, R & I	12-13
Switch, R & I	12-70
HEADLINING PANEL, SUN ROOF	15-39
HEATER:	
Case, R & I	1-72
Core, R & I (Front A/C)	1-73
Core, R & I (Rear A/C)	1-119
HEIGHT CONTROL VALVE, R & I (A.L.C. SYSTEM)	4-20
HIGH BEAM INDICATOR DIAGNOSIS	12-31
HOIST RECOMMENDATIONS	0-5
HOLDING FIXTURE INSTALLATION, ELDORADO TRANSMISSION	7-81
Except Eldorado	7-30
HOOD:	
Adjustment	11-2
Hinge Spring	11-3
Latch Adjustment	11-2
Lock Release	12-73
Removal and Installation	11-2
HORN OPERATION AND TESTING	12-36
HOSE REPLACEMENT, SUN ROOF DRAIN	15-47
HOUSING OIL SEAL, TRANSMISSION EXTENSION, R & I	7-26
HOUSING, TRANSMISSION EXTENSION, R & I	7-26
HOUSING, WHEEL R & I – SEE WHEELHOUSING	
HUB ASSEMBLY, A/C COMPRESSOR, R & I	1-75
HUB AND BEARING, FRONT WHEEL (ELDORADO)	3-24
HUB, REAR WHEEL (ELDORADO)	4-42
HYDRAULIC BRAKE LINE:	
Flaring	5-23
Servicing (Eldorado)	5-57
Servicing (Except Eldorado)	5-22
Tubing	5-23
HYDRO-BOOST	
Accumulator Leak Down Test	5-67
Accumulator Overhaul	5-63
Bleeding Procedure	5-67
Booster Functional Test	5-67
Diagnosis	5-59
General Description	5-59
Hydraulic Brake Booster Overhaul	5-61
Hydraulic Power Brake Booster	5-61
Seal Leak Diagnosis	5-59
Trouble Shooting and Testing	5-66
I	
IDENTIFICATION NUMBERS:	
Components (Unit)	0-2
Vehicle	0-1
IDLE SYSTEM	6-5
IGNITION SYSTEM:	
Component Checks	6-29
Diagnosis	6-28
Distributor:	
Disassemble & Assemble	6-32
Removal & Installation	6-32
Testing	6-30
Theory of Operation	6-27
Tune-Up:	
Ignition Timing Adjustment	6-30
IN-CAR SENSOR, R & I (A/C)	12-67
INDICATOR LAMP CIRCUIT TESTING	12-33
INSPECTION - STARTER MOTOR	6-24
INSTALLATION OF ELECTRICAL ACCESSORIES	12-28
INSTRUMENTS – SEE ELECTRICAL INSTRUMENTS	
INSTRUMENT PANEL:	
Accessory Switches	12-72
A/C Air OUtlet Grilles, R & I	12-61

BACK TO INDEX

DAVE GRAHAM AUTO LITERATURE, INC.
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Subject	Page No.
Bulb Replacement	12-72
A/C Control head, R & I	12-67
A/C In-Car Sensor, R &I	12-67
A/C Outlet Doors & Bezels, R & I	12-65
Air Cushion Restraint System Components	12-75
Ash Tray, R & I	12-69
Bezel:	
Assembly, R & I	12-64
Cigar Lighter, R & I	12-69
Clock, R & I	12-73
Cluster, R & I	12-64
Control Unit, Electronic Fuel Injection, R & I	12-99
Controller, Track Master, R & I	12-72
Cruise Control Switch, R & I	12-70
Duct, A/C Left Side, R & I	12-68
Duct, A/C Right Side, R & I	12-68
Fuel Gage, R & I	12-72
General Information	12-61
Glove Box Door, R & I	12-74
Glove Box Liner, R & I	12-73
Glove Box Lock, R & I	12-74
Guide-Matic Switch, R & I	12-70
Headlight Switch, R & I	12-70
Hood Lock Release, R & I	12-73
Insert, L.H., R & I	12-69
Insert & Applique, R.H., R & I	12-70
Instrument Panel Pad	12-62
Instrument Panel Top Cover	12-63
Lower Steering Column Cover	12-62
Mirror, R.H. Outside, R & I	12-74
Printed Circuit, R & I	12-66
Radio, R & I	12-71
Radio Speaker, R & I	12-71
Rear Window Defogger Timer Relay and Circuit Breaker R & I	12-73
Relay, Power Antenna, R & I	12-72
Speaker Grille, R & I	12-71
Switch, Trunk Release, R & I	12-72
Speedometer Head, R & I	12-65
Tell-Tale Housing, R & I	12-64
Twilight Sentinel Amplifier, R & I	12-66
Twilight Sentinel Photocell, R & I	12-66
Twilight Sentinel Switch, R & I	12-70
Windshield Wiper Switch, R & I	12-68
INTAKE MANIFOLD, R & I	6-165
INTAKE VALVE, R & I	6-172
INTERMEDIATE BAR, FRONT BUMPER (ELDORADO) R & I	14-5

J

JOINT, CONSTANT VELOCITY – SEE CONSTANT VELOCITY JOINT	

K

KEY BUZZER DIAGNOSIS	9-25
KEYS	0-3
KNUCKLE, STEERING:	
Eldorado	3-35
Except Eldorado	3-20

L

LAMP MONITOR SYSTEM:	
Diagnosis	12-41
Front Harness, R & I	12-41
Front Monitor Readout, R & I	12-41
Theory of Operation	12-41
LATCH ADJUSTMENT, HOOD	11-2
LEAF SPRING (6Z):	
Removal & Installation	4-7
Servicing Liner	4-7
LEAK TESTING:	
A/C Compressor	1-98
A.L.C. System	4-18
Cooling System	6-6
Refrigeration System	1-5
LEAK DOWN RATE TEST, VALVE LIFTER	6-169
LEAKAGE POINTS, TRANSMISSION:	
Eldorado	7-74
Except Eldorado	7-19
LEVEL CONTROL, AUTOMATIC:	
Checking	4-17
Compressor Assembly, D & A	4-21
Compressor Assembly, R & I	4-20
Compressor Output Test	4-17
Control Valve, R & I	4-18
General Description	4-15
Leak Test	4-19
Regulator Test	4-18
Trim Adjustment	4-20
Tubing	4-20
LICENSE LAMP:	
Diagnosis	12-7
R & I:	
Eldorado	12-17
Except Eldorado	12-17
LIFTER VALVE:	
Disassemble & Assemble	6-170
Removal & Installation	6-169
LIGHTER, CIGAR, R & I	12-69
LIGHTING SYSTEM:	
Back-Up Light, R & I:	
Eldorado	12-20
Except Eldorado	12-16
Bulb Data Chart	12-22
Bulb Replacement (Eldorado)	12-23
Bulb Replacement (Except Eldorado)	12-19
Cornering Lamp, Front Side Marker Lamp, R & I Cornering:	
Eldorado	12-19
Except Eldorado	12-15
Diagnosis:	
Back-Up Lights	12-9
Cornering Lamps	12-5
Headlamps	12-3
Marker Lamps	12-6
Stop Lights	12-8

BACK TO INDEX

DAVE GRAHAM AUTO LITERATURE, INC.
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Subject	Page No.
Tail, Park, License Lamps	12-7
Turn Signal and Hazard Warning	12-4
Fuses	12-26
Grill Extension R & I:	
Eldorado	12-18
Except Eldorado	12-15
Headlamp, R & I:	
Eldorado	12-18
Except Eldorado	12-13
Headlamp Housing, R & I	12-13
Headlamp Housing Trim Mldg, R & I	12-15
Headlight Aiming:	
With Screen	12-11
Mechanical Method	12-9
License Plate Lamp, R & I:	
Eldorado	12-17
Except Eldorado	12-17
Parking Lamp, R & I:	
Eldorado	12-19
Except Eldorado	12-15
Rear Side Marker, R & I	12-17
Tail, Stop Lamp, R & I:	
Eldorado	12-20
Except Eldorado	12-16
LINE, FUEL:	
Cleaning	8-3
R & I	8-5
LINER, GLOVE BOX, R & I	12-73
LINING BREAK-IN, DISC BRAKES	5-13
LINKAGE ADJUSTMENTS, TRANSMISSION:	
Eldorado	7-76
Except Eldorado	7-22
LINKAGE DIAGNOSIS, STEERING	9-14
LINKAGE PARALLELISM CHECK, STEERING:	
Eldorado	9-72
Except Eldorado	9-28
LINKAGE, STEERING, R & I:	
Eldorado	9-71
Except Eldorado	9-48
LOAD TEST BATTERY	6-18
LOCK, HOOD RELEASE, R & I	12-73
LOCK, GLOVE BOX, R & I	12-74
LOWER BEARING, STEERING COLUMN, R & I	9-60
Lower Cover, Instrument Panel	12-62
Lower Steering Shaft, R & I (Eldorado)	9-70
Lubrication Recommendations	0-11
Lubrication System, Engine	6-157

M

Subject	Page No.
MACHINING DRUM BRAKES	5-18
MAIN BEARING CHECKING AND REPLACEMENT	6-184
MAINTENANCE:	
Cooling System	6-7
Starter Motor	6-23
Sun Roof	15-39
MAINTENANCE RECOMMENDATIONS:	
Air Conditioning Compressor	0-12
Body Lubrication Points	0-15
Car Storage	0-10
Differential	0-15
Emission Control Systems	0-14
Final Drive	0-13
Front Suspension	0-16
Power Brakes	0-14
Power Steering	0-14
Schedule	0-12
Transmission	0-13
Vibration Complaints & Corrections	0-8
Wheel Bearings (Non-Driven Wheels)	0-13
MANIFOLD, EXHAUST, R & I	6-122
MANIFOLD, INTAKE, R & I	6-122
MANUAL LINKAGE ADJUSTMENTS, TRANSMISSION:	
Eldorado	7-76
Except Eldorado	7-22
MARKER LAMP, DIAGNOSIS	12-60
MARKER LAMP, REAR SIDE, R & I:	12-17
Eldorado	12-19
Except Eldorado	12-15
MARKER LAMP, REAR SIDE, R & I:	
MASTER CYLINDER, D & A	5-24
MASTER SWITCH, R & I (REAR A/C)	1-115
METAL TEMPERATURE INDICATOR LAMP DIAGNOSIS	12-33
METRIC–ENGLISH CONVERSION TABLE	16-3
MINOR RADIO ADJUSTMENTS	12-56
MIRROR, R.H. OUTSIDE, R & I	12-74
MODE DOOR ASSEMBLIES, R & I (REAR A/C)	1-115
MODULATOR, TRACKMASTER	5-48
MONITOR, LAMP–SEE LAMP MONITOR SYSTEM	
MOTOR, BLOWER:	
Front A/C, R & I	1-72
Rear A/C, R & I	1-115
MOTOR, SUN ROOF, R & I	15-42
MOUNTING TIRES	10-3
MOUNTS, BODY	2-5
MOUNTS, ENGINE & TRANSMISSION:	
Eldorado	6-164
Except Eldorado	6-163
MOUNTS, RADIATOR CRADLE	13-6

N

Subject	Page No.
NAME PLATE, BODY	0-3
NEUTRAL SWITCH & BACK–UP LIGHT SWITCH:	
Adjustment	12-40
R & I	12-40
NOISE SUPRESSORS, RADIO	12-50
NUMBERS:	
Vehicle Identification	0-1
Component (Unit) Identification	0-2
NUT AND BOLT IDENTIFICATION	16-1

BACK TO INDEX

DAVE GRAHAM AUTO LITERATURE, INC.
© 2008 ALL RIGHTS RESERVED

Subject	Page No.
O	
OIL CHANGE INTERVAL AND VISCOSITY CHART	0-16
OIL, CHECKING AND ADDING, TRANSMISSION:	
Eldorado	7-76
Except Eldorado	7-24
OIL LEAKAGE POINTS, TRANSMISSION:	
Eldorado	7-74
Except Eldorado	7-18
OIL PAN, R & I	6-174
OIL PRESSURE INDICATOR LAMP CIRCUIT	12-32
OIL PUMP:	
R & I	6-174
Servicing	6-174
OIL RECOMMENDATIONS:	
Engine	0-15
Transmission	0-15
OIL SEAL:	
Engine Front Cover, R & I	6-177
Pinion Bearing (Eldorado)	3-56
Transmission Extension Housing	7-26
Transmission Pump	7-29
OIL SEAL REPLACEMENT, REAR MAIN BEARING	6-175
OPERATION OF A/C SYSTEM:	
Front	1-2
Rear	1-102
OUTER END, FRONT BUMPER:	
Eldorado	14-14
Upper (Except Eldorado)	14-8
Lower (Except Eldorado)	14-8
OUTER END, REAR BUMPER:	
Eldorado	14-14
Except Eldorado	14-10
OUTLETS, A/C, R & I	12-61
OUTPUT SHAFT & DRIVE AXLE (ELDORADO):	
Bearing	3-52
Left Side	3-48
Right Side	3-52
Seal Replacement	3-53
OUTSIDE MIRROR, RIGHT HAND, R & I	12-74
OVERCHARGED BATTERY TESTING	6-38
OVERHAUL:	
A/C Compressor	1-75
A/C Programmer	1-99
Differential	4-49
Water Pump	6-9
P	
PAN, OIL, R & I	6-173
PANEL:	
A/C Control:	
D & A, Front	1-174
D & A, Rear	1-114
R & I	12-67
Instrument – See Instrument Panel	
Sun Roof, R & I	15-39
PARKING BRAKE:	
Adjustment	5-10
Assembly, R & I	5-20
Cables:	
Eldorado	5-55
Except Eldorado	5-21
Checks	5-7
Vacuum Diaphragm, R & I	5-20
PARKING LIGHT ASSEMBLY:	
Diagnosis	12-7
Removal & Installation:	
Eldorado	12-19
Except Eldorado	12-15
PHOTO–AMPLIFIER, GUIDE–MATIC, R & I	15-17
PHOTOCELL, TWILIGHT SENTINEL, R & I	12-66
PINION BEARING OIL SEAL, R & I (Eldorado)	3-56
PINION FLANGE RUNOUT	4-64
PISTON:	
Clearance	6-183
Ring Replacement	6-182
PLATE, BODY NAME	0-3
POA VALVE, R & I:	
Front A/C	1-69
Rear A/C	1-117
POPPET VALVE, STEERING GEAR, R & I	9-47
POWER BRAKES:	
Disassemble & Assemble	5-24
Removal & Installation	5-24
POWER RELAY, GUIDE–MATIC, R & I	15-17
POWER SERVO:	
Removal & Installation (Rear A/C)	1-115
Vacuum Valve, R & I (Rear A/C)	1-115
POWER STEERING–SEE STEERING	
PRECAUTIONS, CHARGING SYSTEM	6-37
PRESSURE REGULATOR VALVE, TRANSMISSION:	
Eldorado	7-83
Except Eldorado	7-27
PRINTED CIRCUIT:	
Removal & Installation	12-66
PROPELLER SHAFT	4-25
PULLEY AND BEARING, A/C COMPRESSOR, R & I	1-78
PUMP, FUEL, NON EFI	6-82
EFI	6-127
PUMP DIAGNOSIS, POWER STEERING	9-10
PUMP, OIL, R & I	6-174
PUMP OIL SEAL, TRANSMISSION	7-29
PUMP, OIL SERVICING	6-174
PUMP OVERHAUL, WATER	6-9
PUMP, POWER STEERING:	
Disassemble & Assemble	9-31
Removal & Installation	9-30
PUMP PRESSURE CHECK, POWER STEERING	9-27

BACK TO INDEX

DAVE GRAHAM AUTO LITERATURE, INC.
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Subject	Page No.
PUMP SHAFT SEAL, POWER STEERING, R & I	9-34
PURGING, EVACUATING AND CHARGING REFRIGERATION SYSTEM	1-58
R	
RADIATOR:	
Cradle Mounts	11-2
General Description	11-2
Removal & Installation	11-5
Testing	6-6
RADIO:	
Antenna, Power:	
D & A	12-58
R & I	12-58
Control Operation	12-49
Diagnosis Chart	12-51
Diagnosis Proceduress	12-50
Minor Adjustments	12-56
Noise Suppressors	12-50
Rear Remote Control Unit, R & I	12-57
Speaker:	
Front, R & I	12-71
Grille, R & I	12-71
Rear, Convertible, R & I	12-57
Rear, Except Convertible, R & I	12-56
Theory of Operation	12-45
REAR AXLE (ELDORADO):	
Axle Assembly, R & I	4-44
Bearings & Grease Retainer	4-43
General Description	4-42
Hub	4-42
Special Tools	4-45
Spindle	4-43
Wheel Bearing Adjustment	4-42
REAR AXLE (EXCEPT ELDORADO):	
Axle Shaft, Bearing Oil Seal & Wheel Bearing	4-39
Backlash Measurement	4-38
Diagnosis	4-36
General Description	4-38
Special Tools	4-41
Specification:	
Bearings	4-40
Torque	4-41
REAR MAIN BEARING OIL SEAL REPLACEMENT	6-184
REAR SUSPENSION (ELDORADO ONLY);	
Control Arm, R & I:	
Lower	4-11
Upper	4-10
General Description	4-10
Springs	4-11
Torque Specifications	4-13
Upper Control Arm Bushing	4-11
REAR SUSPENSION (EXCEPT ELDORADO):	
Control Arm, R & I:	
Lower	4-6
Upper	4-6
General Description	4-2
Leaf Spring Liner Service (6ZZ)	4-7
Leaf Spring, R & I (6ZZ)	4-7
Shock Absorber Check	4-4
Shock Absorber, R & I	4-4
Springs	4-5
Standing Height Chart	4-9
Standing Height Check	4-3
Torque Specifications	4-8
REBALANCING PROPELLER SHAFT	4-26
RECOMMENDED FLUIDS	0-15
RECONDITIONING VALVE SEATS	6-173
REFLEX, REAR BUMPER (ELDORADO) R & I	14-14
REFRIGERANT CHARGE CHECKING	1-58
REFRIGERATION:	
Handling Components	1-55
Connecting Charging Station	1-59
Description	1-5
Detection System Diagnosis	1-53
Leak Testing	1-61
Maintenance & Inspection	1-57
Problem Diagnosis	1-51
Purging, Evacuating and Charging	1-58
REGULATOR TEST A.L.C.	4-18
RELAY, GUIDE-MATIC POWER, R & I	15-17
RELINING DRUM BRAKES:	
Except Eldorado	5-17
RELINING FRONT DISC BRAKES	5-11
REPACKING RECOMMENDATIONS, Non-Driven Wheels	0-13
REPLACING LIGHT BULBS:	
Eldorado	12-23
Except Eldorado	12-19
RESISTOR, BLOWER:	
Rear A/C	1-115
RETAINER, REAR AXLE GREASE (ELDORADO)	4-43
RING REPLACEMENT, PISTON	6-182
ROCKER ARM COVERS, R & I	6-166
ROD ALIGNMENT	6-184
ROD BEARING CHECKING AND REPLACEMENT	6-181
ROD AND PISTON, R & I	6-180
RUNOUT, PINION FLANGE	4-64
S	
SAFETY MAINTENANCE:	
Brakes and Power Steering	0-14
Bumpers	0-14
Disc Brakes	0-14
Engine Drive Belts	0-14
Exhaust System	0-14
Headlights	0-14
Owner Safety Checks:	
Brakes	0-13
Defrosters	0-13
Door Latches	0-14
Exhaust System	0-14
Fluid Leaks	0-14
Glass	0-14

BACK TO INDEX

DAVE GRAHAM AUTO LITERATURE, INC.
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Subject	Page No.
Head Restraints	0-14
Hood Latches	0-14
Horn	0-13
Lap and Shoulder Belts	0-13
Lights and Buzzers	0-14
Parking Brake	0-13
Rearview Mirrors	0-13
Seat Back Latches	0-14
Starter Safety Mechanism	0-13
Steering	0-13
Steering Column Lock	0-13
Transmission Park Mechanism	0-13
Transmission Shift Indicator	0-13
Wheel Alignment and Balance	0-14
Windshield Wipers and Washers	0-13
Suspension and Steering	0-14
Throttle Linkage	0-14
Tires and Wheels	0-14
SCHEDULE, MAINTENANCE	0-13
SEAL:	
A/C Compressor Shaft, R & I	1-85
A/C Compressor Shaft Seal	1-83
Control Arm Spherical Joint (Eldorado):	
Lower	3-39
Upper	3-33
Engine Front Cover Oil, R & I	6-177
Output Shaft (Eldorado)	3-53
Pinion Bearing Oil (Eldorado)	3-56
Replacement, Rear Main Bearing Oil	6-184
Replacement, Spherical Joint:	
Lower	3-16
Upper	3-13
Steering Gear Pitman Shaft	9-47
Steering Knuckle Inner (Eldorado)	3-35
Steering Pump Shaft, R & I	9-34
Tie Rod End, R & I	9-51
SEALED BEAM, HEADLAMP, R & I	
Eldorado	12-18
Except Eldorado	12-13
SEAT BELT WARNING	12-33
SENSITIVITY ADJUSTMENT, TWILIGHT SENTINEL	15-25
SENSOR R & I (FRONT A/C):	
In-Car	12-67
SENSORS, R & I (REAR A/C):	
Duct	1-114
In-Car	1-114
SENSOR, THERMAC AIR CLEANER	6-148
SENSOR, TRACKMASTER WHEEL SPEED:	
Except Eldorado	5-47
SERVICE, A/C COMPRESSOR	1-75
SERVICING FRONT ROTORS	5-16
SERVICING POWER STEERING COOLER	9-28
SERVO, A/C REAR UNIT POWER, R & I	1-115
SERVO, CRUISE CONTROL, R & I	15-12
SHAFT, OUTPUT AND DRIVE AXLE (ELDORADO):	
Left	3-48
Right	3-47
SHAFT, OUTPUT BEARING (ELDORADO)	3-52
SHAFT, OUTPUT SEAL (ELDORADO)	3-53

Subject	Page No.
SHAFT SEAL, A/C COMPRESSOR, R & I	1-83
SHAFT SEAL, STEERING PUMP, R & I	9-34
SHAFT, STEERING COLUMN, REPAIR	9-60
SHAFT, STEERING LOWER, R & I (ELDORADO)	9-70
SHIM CHART, DIFFERENTIAL	4-65
SHEET METAL:	
Adjusting Tolerances	11,9,10
Fender, R & I:	
Eldorado	11-5
Except Eldorado	11-3
General Description	11-1
Hood Adjustment	11-2
Hood Hinge Spring, R & I	11-3
Hood Latch Adjustment	11-2
Hood, R & I	11-2
Specifications	11-9
Torque Specifications	11-8
Wheelhousing, R. & I:	
Eldorado	11-7
Except Eldorado	11-3
SHOCK ABSORBER:	
Checking:	
Front	3-11
Rear	4-4
Front, R & I:	
Eldorado	3-31
Except Eldorado	3-11
Rear, R & I	4-4
SHOE ADJUSTMENT, REAR BRAKE	5-10
SIDE MARKER LAMP DIAGNOSIS	12-6
SIDE MARKER LAMP, FRONT, R & I:	
Eldorado	12-19
Except Eldorado	12-15
SIDE MARKER LAMP, REAR, R & I	12-17
SLIDE, SUN ROOF	15-43
SLIP YOKE, R & I	4-31
SOLENOID, TRACKMASTER	5-48
SPEAKER GRILLE, RADIO, R & I	12-71
SPEAKER, RADIO, R & I	12-71
SPEAKER, RADIO REAR SEAT, R & I:	
Convertible	12-57
Except Convertible	12-56
SPECIFICATIONS:	
Brakes:	
Eldorado	5-68
Except Eldorado	5-33
Charging Systems	6-51
Cooling System	6-14
Differential	4-65
Engine	6-187
Front Suspension (Except Eldorado)	3-3
Rear Axle	4-40
Sheet Metal (Except Eldorado)	11-9
Wheels and Tires	10-1
SPECIAL TOOLS:	
Air Conditioning	1-120
Charging System	6-52
Cooling System	6-15
Differential	4-67
Engine	6-191

BACK TO INDEX

DAVE GRAHAM AUTO LITERATURE, INC.
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Subject	Page No.
Final Drive (Eldorado)	3-54
Front Suspension	3-26
Fuel System	6-85
Guide-Matic	15-10
Propeller Shaft	4-35
Rear Axle (Eldorado)	4-45
Rear Axle (Except Eldorado)	4-41
Rear Suspension	4-14
Steering	9-74
Trackmaster	5-35
Transmission:	
Eldorado	7-115
Except Eldorado	7-68
Wheels and Tires	10-18
SPEEDOMETER HEAD:	
Disassemble & Assemble	12-65
Removal & Installation	12-65
SPHERICAL JOINT CHECKING:	
Eldorado	3-32
Except Eldorado	3-13
SPHERICAL JOINT REPACKING (EXCEPT ELDORADO)	3-15
SPHERICAL JOINT REPLACEMENT (ELDORADO):	
Lower	3-39
Upper	3-33
SPHERICAL JOINT SEAL REPLACEMENT	3-37
SPINDLE, REAR AXLE (ELDORADO)	4-43
SPRING LINER SERVICE (6Z)	4-6
SPRING, HOOD HINGE, R & I	11-3
SPRING, VALVE, R & I	6-120
SPRINGS, REAR, R & I:	
Eldorado	4-12
Except Eldorado & 6ZZ	4-5
6ZZ	4-7
STABILIZER BAR, FRONT, R & I:	
Eldorado	3-31
Except Eldorado	3-12
STANDING HEIGHT CHART	3-7
STANDING HEIGHT CHECK, FRONT:	
Eldorado	3-7
Except Eldorado	3-27
STANDING HEIGHT CHECK, REAR	4-3
STARTING SYSTEM:	
Circuit	6-23
Cranking Voltage Test	6-19
Diagnosis	6-19
Fusible Link Repair	12-27
Inoperative Motor	6-22
Inspection	6-24
Maintenance	6-23
Motor, D & A	6-24
Motor, R & I	6-23
Resistance Test	6-21
Starter Motor Tests	6-24
Starter Pinion Clearance	6-22
Theory of Operation	6-20
STEERING COLUMN LOWER COVER	12-62
STEERING (ELDORADO ONLY);	
Gear Assembly, R & I	9-68
General Description	9-68
Idler Arm	9-68
Linkage	9-68
Drag Link Height Adjustment	9-72
Lower Steering Shaft, R & I	9-70
Lower A.C.R.S. Steering Shaft Only, R & I	9-71
Pitman Arm	9-70
Special Tools	9-74
Thrust Bearing Adjustment	9-44
Torque Specifications	9-73
STEERING:	
Checking:	
Fluid Level	9-27
Pump Pressure	9-27
Steering Column	9-67
Column:	
Alignment	9-28
Lower Bearing, R & I	9-60
Steering Shaft, Repair	9-60
Diagnosis:	
Gear and Pump	9-10
Key Buzzer	9-25
Linkage	9-14
Standard Column	9-15
Turn Signal Switch	9-22
T & T Column	9-18
Gear Assembly, R & I:	9-35
Major Component:	
Disassembly & Assembly	9-37
Installation	9-42
Removal	9-35
Seats & Check Valve, R & I	9-47
General Description	9-1
Drag Link	9-50
Idler Arm	9-51
Linkage	9-48
Linkage Parallelism	9-28
Pitman Arm	9-52
Pitman Shaft Seals, R & I	9-47
Pump:	
Disassembly & Assembly	9-31
Removal & Installation	9-30
Shaft Seal, R & I	9-34
Servicing Fluid Coller Tube	9-28
Special Tools	9-74
Standard Column, D & A	9-56
Steering Column, R & I	9-53
Tie Rod	9-49
Adjuster Tube	9-51
End Seal, R & I	9-52
Tilt Column, D & A	9-62
Torque Specifications	9-73
STEERING KNUCKLE, R & I (EXCEPT ELDORADO)	3-21
STEERING KNUCKLE AND INNER SEAL (ELDORADO)	3-35
STEERING SYSTEM MAINTENANCE	0-14
STOP LIGHT DIAGNOSIS	12-8
STOP LIGHT, SIGNAL LIGHT, R & I:	
Eldorado	12-20
Except Eldorado	12-16
STOP LIGHT SWITCH ADJUSTMENT	5-11

BACK TO INDEX

DAVE GRAHAM AUTO LITERATURE, INC.
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Subject	Page No.
STORAGE PRECAUTIONS, FUEL TANK	8-3
STORAGE PREPARATION	0-10
SUCTION THROTTLING VALVE, R & I:	
Rear A/C	1-117
SUNROOF:	
Adjustments	15-39
Control Switch, R & I	12-72
Diagnosis	15-39
Drain Hose Replacement	15-47
Headlining Panel, R & I	15-39
Motor and Gearbox, R & I	15-42
Panel, Rear Slide and Cable, R & I	15-43
Periodic Maintenance	15-47
Theory of Operation	15-37
Weather Strip Replacement	15-47
SUPERHEAT SWITCH, R & I	1-74
SUPPORT MOUNTS, ENGINE AND TRANSMISSION:	
Eldorado	6-164
Except Eldorado	6-163
SUPPORT YOKE, R & I	4-31
SUPPRESSORS, RADIO NOISE	12-50
SUSPENSION ARM BUSHING, LOWER (EXCEPT ELDORADO)	3-20
SUSPENSION ARM, (EXCEPT ELDORADO):	
Lower	3-20
Upper	3-17
SUSPENSION ARM SHAFT, UPPER (EXCEPT ELDORADO)	3-17
SUSPENSION MAINTENANCE FRONT	0-14
SWITCH, A/C SUPERHEAT, R & I	1-85
SWITCH, BACK-UP LAMP	
Adjustment	12-40
Removal and Installation	12-40
SWITCH CONVERTIBLE TOP CONTROL, R & I	12-72
SWITCH, CRUISE CONTROL:	
Brake Release, R & I	15-11
Engagement	15-11
On-Off, R & I	12-70
SWITCH DIAGNOSIS, TURN SIGNAL	9-22
SWITCH GUIDE-MATIC, R & I:	
Control	12-70
Foot	15-17
SWITCH, HEADLIGHT CONTROL, R & I	12-70
SWITCH, MASTER (REAR A/C)	1-115
SWITCH, POWER ANTENNA CONTROL, R & I	12-72
SWITCH, REAR WINDOW DE-FOGGER, R & I	12-72
SWITCH SUNROOF, R & I	12-72
SWITCH, THEFT DETERRENT SYSTEM, HOOD	15-29
SWITCH, TRANSMISSION DOWNSHIFT	7-23

T

TAILIGHT DIAGNOSIS	12-7
TAILIGHT, R & I	12-16
TANK CLEANING, FUEL	8-3
TANK, FUEL, R & I	8-3
TANK UNIT, FUEL GAGE	12-29
TAPE PLAYER - THEORY OF OPERATION	12-48
TEMPERATURE CONTROL PROBLEM DIAGNOSIS OF FRONT A/C SYSTEM	1-41
TEMPERATURE LAMP DIAGNOSIS:	
Metal	12-33
Water	12-32
TESTER, USE OF A.T.C. FRONT A/C SYSTEM	1-54
TESTER, USE OF A.T.C. REAR A/C SYSTEM	1-109
TESTING A/C COMPRESSOR FOR LEAKS	1-98
TESTING A/C CONTROL SYSTEM FUNCTION	1-45
TESTING A/C COOLING CAPACITY PERFORMANCE:	
Rear System	1-109
TESTING A.L.C. SYSTEM FOR LEAKS	4-19
TESTING BATTERY	6-13
TESTING CONTROL VALVE A.L.C.	4-18
TESTING FUEL PUMP	
NON E.F.I.	6-82
E.F.I.	6-94
TESTING GENERATOR OUTPUT	6-37
TESTING HORN OPERATION	12-36
TESTING REFRIGERATION SYSTEM FOR LEAKS	1-61
TESTING REGULATOR A.L.C.	4-18
TESTING THERMAC AIR CLEANER	6-147
THEFT DETERRENT SYSTEM:	
Control Box, R & I	15-34
Diagnosis Chart	15-32
Electrical Circuit Checks	15-32
Fuse Block Cover, R & I	15-29
General Description	15-29
Hood Sensing Switch, R & I and Adjustment	15-34
Performance Test	15-32
Service Information	15-34
THERMOSTAT, R & I	6-8
THERMOSTAT TEST	6-7
TIE ROD END SEAL, R & I	9-52
TIE-STRUT, FRONT SUSPENSION, R & I (EXCEPT ELDORADO)	3-12
TILT COLUMN, D & A	9-62
TIMING ADJUSTMENT, IGNITION	6-30
TIRES – SEE WHEELS AND TIRES	
TOLERANCES, SHEET METAL:	
Eldorado	11-10
Except Eldorado	11-9
TOOLS, SPECIAL SERVICE – SEE SPECIAL TOOLS	
TORSION BAR, R & I (ELDORADO)	3-34

BACK TO INDEX

DAVE GRAHAM AUTO LITERATURE, INC.
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Subject	Page No.
TORSION DAMPNER, PROPELLER SHAFT (6DF-6ZZ)	4-28
TORQUE SPECIFICATIONS:	
Brakes:	
Eldorado	5-69
Except Eldorado	5-34
Bumpers	14-1
Charging System	6-52
Differential	4-66
Engine	6-189
Final Drive (Eldorado)	3-54
Front Suspension	3-25
Fuel Injection	6-140
Fuel System	6-84
Propeller Shaft	4-34
Radiator	13-5
Sheet Metal	11-8
Steering	9-73
Transmission:	
Eldorado	7-115
Except Eldorado	7-67
TRACKMASTER:	
Circuit Diagram	5-46
Controller	5-48
Controller – Modulator Harness	5-48
Diagnosis	5-38
Major System Components	5-35
Modulator	5-48
Solenoid	5-48
Theory of Operation	5-35
Transmission Speed Sensor (Except Eldorado)	5-47
TRANSDUCER, CRUISE CONTROL	15-12
TRANSDUCER, R & I (REAR A/C)	1-117
TRANSMISSION (ELDORADO):	
R & I	7-78
Case Repairs	7-19
Converter	7-114
Diagnosis	7-70
Disassembly, Cleaning, Inspection, And Assembly of Individual Units	7-91,111
Downshift Switch:	
Adjustment	7-76
Removal and Installation	7-23
Governor Assembly	7-113
Pressure Regulator Valve	7-111
Fluid:	
Checking & Adding	7-76
Leakage Precautions	7-74
Installing on Holding Fixture	7-81
Linkage Adjustment, Manual	7-76
Major Components:	
Removal	7-81
Installation	7-91
Oil Leaks	7-74
Oil Pump	7-105
Removal & Installation	7-78
Special Tools	7-115
Torque Specifications	7-115
Units That Can Be Removed With Transmission in Car	7-77
TRANSMISSION (EXCEPT ELDORADO):	
Case Repairs	7-19
Converter	7-30
Diagnosis	7-1
Disassembly, Cleaning, Inspection and Assembly of Individual Units	7-38
Downshift Switch:	
Adjustment	7-24
Removal and Installation	7-23
In-Car Service Operations:	
Extension Housing	7-26
Extension Housing Oil Seal, R & I	7-26
Pressure Regulator Valve, R & I	7-27
Fluids:	
Checking and Adding	7-24
Leakage Precautions	7-19
Linkage Adjustment, Manual	7-22
Major Components:	
Removal	7-30
Installation	7-60
Oil Leaks	7-19
Pressure Regulator Valve, R & I	7-27
Pump Oil Seal Replacement	7-29
Removal and Installation	7-28
Special Tools	7-68
Torque Specifications	7-67
TRANSMISSION MOUNTS:	
Eldorado	6-164
Except Eldorado	6-163
TRANSMISSION OIL RECOMMENDATIONS	0-15
TRIM ADJUSTMENT A.L.C. SYSTEM	4-20
TRUNK LID DIAGNOSIS, ELECTRIC	12-31
TUBING, A.L.C. SYSTEM	4-20
TUBING, HYDRAULIC BRAKE LINE: FLARING	5-23
Servicing (Eldorado)	5-57
Servicing (Except Eldorado)	5-22
TUNE-UP – SEE IGNITION SYSTEM	
TURN SIGNAL LIGHTS DIAGNOSIS	12-4
TURN SIGNAL SWITCH:	
Diagnosis	9-22
R & I, Std. Column	12-38
T & T Column	12-39
TWILIGHT SENTINEL:	
Amplifier, R & I	12-66
Control Switch, R & I	12-70
Diagnosis	15-20
Operation & Correction	15-19
Photocell, R & I	12-66
Sensitivity Adjustment	15-25
Theory of Operation	15-18

U

UNDERCHARGED BATTERY	6-37

BACK TO INDEX

DAVE GRAHAM AUTO LITERATURE, INC.
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Subject	Page No.
UNIVERSAL JOINT, CONSTANT VELOCITY (EXCEPT ELDORADO)	(See Drive Shaft)
UNIVERSAL JOINT, INNER CONSTANT VELOCITY (ELDORADO)	3-51
UNIVERSAL JOINT, OUTER CONSTANT VELOCITY (ELDORADO)	3-48
UPPER LEVEL VENTILATION DOOR	1-17
V	
VACUUM DIAGRAMS:	
Front A/C	1-17
Rear A/C	Rear Gatefold
VACUUM DIAPHRAGM, PARKING BRAKE, R & I	5-20
VACUUM MOTOR, THERMAC AIR CLEANER, R & I	6-149
VACUUM POWER HEAD, D & A	5-26
VACUUM PROBLEMS IN AUXILIARY CIRCUITS, FRONT A/C SYSTEM	1-49
VALVE, A.I.R. SYSTEM DIVERTER, R & I	6-97
VALVE, INTAKE OR EXHAUST, R & I	6-172
VALVE LIFTER:	
Disassemble & Assemble	6-170
Leak-Down Rate Checking	6-169
Removal & Installation	6-169
VALVE, P.C.V., R & I	6-142
VALVE, POA-STV, R & I:	
Front A/C	1-69
Rear A/C	1-117
VALVE, POWER SERVO VACUUM (REAR A/C)	1-115
VALVE, REAR A/C EXPANSION, R & I	1-119
VALVE SEAT RECONDITIONING	6-173
VALVE SPRING, R & I	6-120
VALVE, STEERING GEAR POPPET CHECK, R & I	9-47
VALVE, TRANSMISSION PRESSURE REGULATOR, R & I:	
Eldorado	7-111
Except Eldorado	7-27
VALVE, WATER CONTROL:	
Front A/C	1-73
Rear A/C	1-114
VEHICLE IDENTIFICATION NUMBER	0-1
VERTICAL AIMING, GUIDE-MATIC	15-17
VIBRATION COMPLAINTS AND CORRECTION	0-8
VIBRATIONS, TIRE	10-6
VISCOSITY CHART, ENGINE OIL	0-16
VOLTAGE ADJUSTMENT (H.D. GENERATOR ONLY)	6-40
W	
WASHER FLUID LEVEL INDICATOR SYSTEM:	
Diagnosis	12-44
General Description	12-43
WATER CONTROL VALVE, R & I (A/C):	
Front System	1-73
Rear System	1-114
WATER PUMP OVERHAUL	6-9
WATER TEMPERATURE INDICATOR LAMP DIAGNOSIS	12-32
WEATHERSTRIP REPLACEMENT, SUN ROOF	15-47
WHEEL BEARING ADJUSTMENT, REAR (ELDORADO)	4-42
WHEEL BEARING, FRONT (EXCEPT ELDORADO)	3-22
WHEEL BEARING, REAR:	
Oil Seal, R & I	4-39
Removal & Installation	4-39
WHEEL BEARING REPACKING (NON-DRIVEN WHEEL)	0-14
WHEELHOUSING, R & I:	
Eldorado	11-7
Except Eldorado	11-3
WHEEL, STEERING, R & I	9-52
WHEELS & TIRES:	
Diagnosis	10-6
General Description	10-1
Installation of Tire & Wheel Assembly	10-2
Mounting & Demounting	10-3
Radial Forces	10-15
Special Tools	10-18
Specification Tables	10-1
Tire:	
Correcting Non-Uniform Tires	10-15
Problem Detector	10-9
Repair	10-3
Rotation	10-2
Wheel Balance	10-3
Wear	10-6
Vehicle Directional Lead	10-16
Vibration & Roughness	10-6
Wheel, Valve and Fastening Table	10-1
WINDSHIELD WIPER AND WASHER SYSTEM:	
Electrical Circuit	12-42
General Description	12-42
Wiper, Washer Switch	12-42
X	
X-VALVE (EXPANSION VALVE), R & I (Front A/C)	1-69
R & I (Rear A/C)	1-119
Y	
YOKE, DRIVESHAFT LINK, R & I	4-32
YOKE, DRIVESHAFT SLIP, R & I	4-32

BACK TO INDEX

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